THE DENTAL PRACTITIONER

AND DENTAL RECORD

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Vol. VIII, No. 6 February, 1958

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THE DENTAL PRACTITIONER
AND DENTAL RECORD

Vol. VIII, *No.* 6

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February, 1958

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THE DENTAL PRACTITIONER AND DENTAL RECORD

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EDITORIAL

FULL DENTURES

DESPITE the fact that vast numbers of full dentures have been made over the last hundred years (the first vulcanite denture was made in 1856), there are still many problems to be faced in this branch of dentistry. While the contribution by prosthetists to our knowledge in this field is extensive, we should not forget that a great deal has been added by the fundamental research carried out by anatomists, physiologists, and orthodontists. Until recent years, it may be fairly stated that the prosthetist has tended to concentrate his research on the mechanical and materials aspects of the problem, while the biological aspects have been dealt with by other branches of medical and dental science. Much has been achieved, and continued co-operation in research projects will undoubtedly shed more light on some of the obscure problems in the wearing of full dentures. It can be difficult and trying to explain to a patient why one person seems able to wear dentures for a lifetime without a moment's trouble, while another spends years of agony with a score or more dentures to show for his pains. Dentures are highly individual appliances made to perform a biological function and their foundation is the tissue upon which they are placed. So much is known about the production and material aspects of full dentures that future research will surely tend to follow the paths of biology. Age changes in the tissue need much further investigation, particularly in relation to the temporomandibular joint and the alveolar bone. From another point of view, for example, the effect of saliva on the retention of dentures is largely an unknown factor, as indeed is the converse—whether the wearing of dentures can effect the saliva. Even if 90 per cent of denture wearers are satisfied with their artificial masticatory apparatus, the profession itself cannot be satisfied until this figure becomes 100 per cent. Full dentures are a very necessary part of dentistry and it can be disconcerting to fit them for a patient in the hope that his troubles will be over, only to find that he becomes the most regular and disappointed patient in the practice. Research is being carried out in this country and abroad on these problems and we feel sure that by co-operation with all branches of dentistry and basic sciences they will ultimately be solved. The article by Boucher in this number will no doubt stimulate interest in these problems, for it shows quite clearly the biological basis for good prosthetic treatment.

R.A.F. Dental Appointment

Group Captain Harold Keggin, assistant to the Director of Dental Services, Royal Air Force, for the past year, has taken up the appointment of Deputy Director of Dental Services with the acting rank of Air Commodore.

A FUNDAMENTAL APPROACH TO THE PROBLEMS OF IMPRESSIONS FOR COMPLETE DENTURES*

By **CARL O. BOUCHER,** D.D.S., F.A.C.D., F.A.D.P., *Columbus*

THE success or failure of artificial dentures depends largely upon the relation of the dentures to the structures which support and limit them. A thorough understanding of these structures is essential to the diagnosis and the prognosis for every patient. It is necessary that the tissue surface of dentures conform perfectly with the tissues which support them in order that a maximum of retention and stability may be obtained. It is not enough that the dentures are in contact with the correct tissues. The contact must be such that the normal function of the structures is not impaired.

The physical forces which can be utilized to retain complete dentures are adhesion and atmospheric pressure. Adhesion is directly proportional to the area covered. A study of the anatomy of the mouth will reveal all of the possible area which may be covered. The use of atmospheric pressure as a retentive force depends upon the proper formation of a border seal. In order that this seal may be effective it must be formed so that it will be maintained throughout all functional movements of the mouth and jaws. A study of the muscles of the jaws and other limiting structures will serve as a guide in the formation of the borders of dentures.

Dentures are constructed to rest directly upon the mucous membrane, but the blood- and nerve-supply for the oral tissues are under it. Care must be taken to avoid pressure on this life line to the tissues. Therefore, it is necessary to know the exact location of the vessels and nerves under dentures.

The thickness of soft tissues over the maxillæ and mandible varies greatly in different parts of the mouth. Some areas require additional pressure, and others require relief, so that forces of mastication will have equal distribution over the supporting area. The basis for the location of these areas is anatomy.

Descriptive anatomy alone is not enough. There must be a thorough understanding of the way in which the anatomic structures function, as well as of the location of various structures. I will attempt to make a correlation between the fundamental anatomy and the practical application of it.

When an impression is to be made for a patient, the dentist should think not only of what is seen as surface anatomy, but he should think of the structures under the surface as well. The labial frænum has no muscle, but the buccal frænum has the caninus muscle in relation to it (*Fig.* 1). The buccal vestibule is the space between the cheek and the ridge and is available for the flange of the denture. It varies in its volume with the action of the buccinator muscle, the position of the mandible, and with the contraction or lack of contraction of the masseter muscle. The dentist should think of the structures under the mucous membrane, and of the varying thicknesses of the soft tissues which are there. He should think of the blood- and nerve-supply coming through the incisive canal at the incisive papilla and realize that those structures are there even though the impression records the surface alone.

The upper labial frænum does not need clearance in the labial flange for movement of the lip from side to side. All it needs is sufficient space in the flange to accommodate it when the lip is pulled down by the action of the orbicularis oris muscle. The thickness of the labial flange must be built to replace the amount of soft tissue and bone that has been lost through surgery and resorption. In other words, the dentist must think of æsthetics when the anterior section of the impression is built.

* A paper delivered to the American Dental Society of Europe, July 11, 1956.

At the buccal frænum (a muscle of facial expression), the caninus muscle is involved. It must be provided with freedom to move forward and back, as it is pulled forward by the orbicularis oris, and backward by the buccinator muscle. The buccinator muscle fibres are in a horizontal position, and turn in front of the ramus to attach to the pterygomandibular raphe.

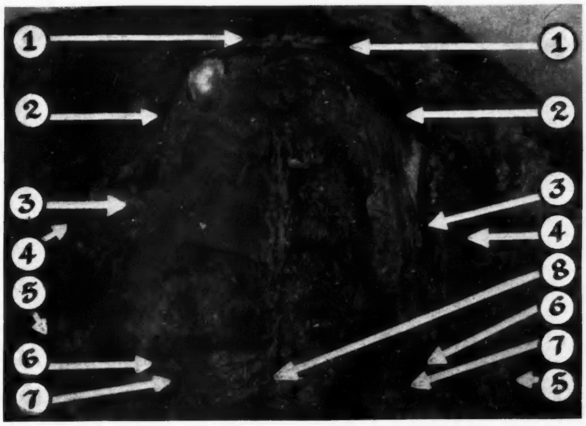

Fig. 1.—Limiting structures of the upper jaw. 1, Labial mucous membrane reflection. 2, Buccal frænum and caninus muscle. 3, Buccal vestibule. 4, Buccinator muscle. 5, Ramus. 6, Hamular notch. 7, Pterygoid hamulus. 8, Muscles of the soft palate back of vibrating line. (*Figs.* 1–4 *reprinted from* "*The Journal of Prosthetic Dentistry*", 1951, 1, 472.)

The pterygomandibular raphe attaches to the pterygoid hamulus and marks the distal side of the pterygomaxillary or hamular notch. The pterygomaxillary notch is the only place a postpalatal seal can be placed (distal to the ridge) without disturbing tissues which should not be displaced, or tissues which would be hypersensitive. The pterygoid hamulus is such a narrow and sharp piece of bone that a slight amount of pressure on it would cause pain and discomfort for the patient. So the margin of the denture is located within the hamular notch, and the extra pressure of the postpalatal seal is placed at the centre of the notch. Then the postpalatal seal is extended across the palate 2 mm. in front of the vibrating line. The denture should extend to the vibrating line which is the imaginary line across the palate which marks the beginning of motion in the palate. The denture that extends to the vibrating line will not cause the tickling that causes a gagging reaction on the part of some patients.

Anteriorly from the vibrating line in the centre of the palate, the palate is relatively hard because of the lack of soft tissue bulk over it (*Fig.* 2). A soft area exists on either side of the hard area. These soft areas are soft because palatal glands underlie the mucous membrane. The blood- and nerve-supply to the posterior two-thirds of the palate lies deep to the palatal glands. The thickness of the palatal glands, and the fact that they *are* glands, means that that portion of the mouth is not much good for the support of a denture. It does, however, provide for additional retention. The rugæ area is covered with soft tissue closely attached to the bone. This means that that portion of the mouth can serve as a secondary supporting area. As such it resists a forward movement of the denture.

When an impression is to be made for a patient, we first observe the colour of the mucous membrane and the shape of the mouth generally. Then we visualize these various anatomic structures, and even before we select the metal tray for making the

impression, we visualize the shape of the finished denture. This is done by recognizing the space that is available between the ridge and the cheek, the amount of bulk required for the proper support of the lip for æsthetics, and the anatomic structures which will surround the denture. The denture should be extended to the limits of the health and the function of the tissues so that every denture border will end in movable tissues, and so that it covers the maximum amount of mucous membrane surface. An underextended denture will not supply the support, or the retention, or the stability which is desirable. We need to make full use of the available space within the oral cavity.

The labial flange of the denture should contain a narrow notch to accommodate the labial frænum. A wide notch developed by pulling the lip from side to side during the moulding of the borders of the impression reduces the area covered by the denture and makes an imperfect seal. However, in the region of the buccal notch, the orbicularis oris muscle pulls the buccinator and the caninus muscles forward, and the buccinator muscle pulls the caninus muscle and buccal frænum backward. A broad groove is required in the buccal notch in order to provide for the function of those tissues. There is quite a variation in the notches provided for both the buccal and labial frænula for different patients.

We must develop the shape of the denture to correspond to the individual characteristics of each patient, but within basic limits.

Thickness of Labial Flange.—The length of time the teeth have been out and the amount of ridge resorption will determine the thickness of the labial flange. A study of the relative position of the natural teeth to the ridge will provide the guide. The labial surface of the root of the natural teeth is close to the labial surface of the alveolar ridge. The contour of the lip is determined not only by the thickness and the intrinsic structure of the lip, but it is also determined by the shape of the labial surface of the mucous membrane and bone, and by the shape and position of the labial surface of the teeth. When the teeth are first removed, there is no space up in the labial vestibule for a labial flange of a denture, but one should be used regardless. When the teeth are first removed, the free margins of the gum fold into the socket, and the lip falls back into the space that is thus developed. The ideal restoration when the teeth are first removed is one that has a very thin labial flange, with the labial surface and the incisal edge of the tooth in exactly the same position as they were in the natural tissues. This will produce the least amount of change of contour of the lip and still provide adequate retention. If the teeth have been out a long time, there will be more destruction of the residual ridge, and more support for the lip will be required. The labial flange of the denture must be made thicker, and therefore the labial flange of the impression must be made thicker.

The Buccal Flange.—The buccal flange must fill the space between the ridge and the cheek. If this is not accomplished, surface contact is reduced. The space must be filled but it must not be overfilled. If the flange of the denture is extended close to a zygomatic process when it is thinly covered with soft tissue, it may interfere with the stability of the denture because of the proximity of that bone to the denture, and relief may have to be provided for it. Mouths are not symmetrical and dentures are not necessarily symmetrical. We fill the space that is available even though it may be different on the two sides.

The Postpalatal Seal and Relief.—The presence of a layer of palatal glands just anterior to the vibrating line provides the cushioning which makes possible the postpalatal seal of the denture (*see Fig.* 2). If it were not for these glands, it would not be possible for us to put a postdam on a denture. A broad postdam will tend to push down on the denture and dislodge it. A narrow bead about 1·0 mm. high and 1·0 mm. wide at the base will sink into the palatal glands, and require the minimum of force for displacing them, and make just as adequate a seal as one with a broad surface. No attempt should be made to postdam any portion of the mouth which is thinly covered by soft tissues. In comparing the fibrous connective tissue which covers the crest of the residual ridge, and the

tissue that covers the median palatine suture, we find that there is a lack of submucosal tissue at the midline of the palate and a greater bulk of soft tissue on the crest of the residual ridge. An increase in the amount of bulk means an increase of cushioning, and more movement of the denture base. It is for this reason that we provide relief over the median portion of the denture. We do not the denture. Provisions are made for the moving structures, such as the caninus muscle, and for the ramus, masseter, and buccinator muscles. Posterior to the ridge, the pterygo-mandibular raphe extends from the pterygoid hamulus down to the top inside back corner of the retromolar pad on the mandible.

The primary supporting area is the crest of the ridge. The secondary supporting area is

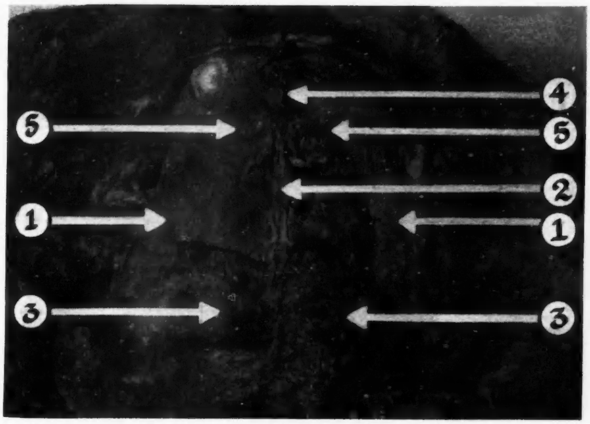

Fig. 2.—Supporting structures of the upper jaw. 1, Fibrous connective tissue on the crest of the ridge. 2, Median suture. 3, Palatal glands and anterior palatine vessels and nerve. 4, Incisive papilla and naso-palatine vessels and nerve. 5, Rugæ area.

relieve the glandular structures on either side, neither do we put additional pressure on these glands as some clinicians would have us do. We believe that palatal glands should function with the minimum amount of distortion of their contour. As a general rule, the more convex the centre of the palate, the more relief will be required.

Anteriorly, we always carry the relief forward where it will cover and protect the blood- and nerve-supply entering the mouth under the incisive papilla. Posteriorly, it is outlined according to the relative hardness of the tissue. Usually, its outline will follow the convexity in the palate.

The Basal Seat.—On the basis of this discussion, the upper arch can be divided into areas according to their function. The valve seal area involves the placing of the border of the denture in the movable tissues surrounding the rugæ area. The relief area is in the region of the median raphe and relief is extended forward to include and protect the incisive papilla. The relief varies in thickness from 20 gauge or more to 24 gauge or less. Relief is accomplished by adding metal of the desired shape and thickness to the cast. The secondary retentive area is the glandular area on either side of the median raphe. It does not support the denture because it is not the right kind of tissue properly attached to the bone.

A high V-shaped vault will not usually require relief, because in most cases there is a lack of hardness in the vault. Even in these cases, relief is always provided for the incisive papilla to protect the blood- and nerve-supply to the anterior part of the palate.

Health of the Tissues.—The state of the health of the tissues in the mouth is extremely important to the success of dentures.

Edentulous patients should be required to do whatever is necessary to get the tissues in their mouths as healthy as possible. When a patient with inflamed and swollen tissue in the mouth insists that dentures be made for him immediately, we do him a dis-service and he does us a dis-service if we give in to his demands. Dentures should never be made for patients who will not first get their mouth healthy. Naturally, some patients will object to this, but if a surgeon tells them they should go into the hospital a week before they have an operation, they would do it and would not question the surgeon's judgement. We, also, work on living tissues, and we have a right to insist that our patients do what they can to make for more successful denture treatment. If we do not do this, it is obvious that the denture would fit the swollen tissue and that it will not fit the tissue after it becomes healthy. If the mouth condition is bad enough, i.e., if the movable tissue is bulky enough, it may be necessary to have it removed surgically. After hyperplastic tissue is removed, we insist upon waiting a period of from 2 to 6 weeks before we make the final impressions.

If an excessive amount of hyperplastic tissue is removed from the anterior part of the mouth, we extend the distal end of the denture back of the vibrating line, and bend the soft palate up by means of the postpalatal seal. This procedure will overcome the unfavourable leverage which is developed by placing the anterior teeth in front of the ridge.

Roentgenograms.—Most authors writing on complete dentures mention the necessity for roentgenograms. They suggest that residual infection, retained roots, and unerupted teeth can be located by this means. However, other things which are of equal importance can be learned from roentgenograms. These relate to the structure of the bone itself. The presence of a good layer of cortical bone over bone with good dense internal structure would indicate a favourable prognosis. A lack of cortical bone would indicate that the prognosis would be poor. A ridge might look very good as one looks at the mucous membrane, particularly if one allows it to get healthy before attempting to make the impression. But the bone inside might have large nutrient canals which are visible in the roentgenograms, and an absence of cortical bone on the surface which would indicate that the prognosis would not be good. Roentgenograms will prevent our getting into difficulty by surgery when a large tuberosity contains an excessively large sinus.

The Upper Impression.—The size and location of the various anatomic structures are noted and projected in our mind to determine what the patient will require in the way of a denture. A metal tray is selected which is oversize for the residual ridge. It should have about 6 mm. of space between the metal surface and the tissue. This will provide 6 mm. of thickness of black modelling plastic in the preliminary impression. The primary objective of the preliminary impression is bulk with which to work. The preliminary impression is removed from the metal tray, and observations are made at the mouth, and with the preliminary impression in the hands, to determine the height and thickness of the flanges. These visual measurements are made and marked on the impression. It is then knife trimmed to the shape and size indicated. The distal end of the impression is trimmed to extend 2 mm. beyond the vibrating line and to the distal side of the hamular notch.

After the excess modelling plastic has been removed by knife trimming, we heat the entire inside surface of this impression and temper it in water at 135° F., and put it back in the mouth with pressure. This is done to record more detail on the impression surface of the modelling plastic. If the borders of the preliminary impression have been bent, that can be detected at this time. After the interior surface is readapted, we heat a section of the flange and mould the borders by manipulation of the soft tissues. This procedure is carried out entirely around the impression. If some portion of the preliminary impression is short, a lower fusing modelling plastic is added to that part of the border and chilled. Then those parts are reheated and the tray is reinserted. Assuming that the labial flange has been adjusted according to the needs for aesthetic support of the lip, and assuming that the buccal flanges fill the available space

between the ridge and the cheek, the post-palatal seal is formed. It is made of still lower fusing modelling plastic. The green stick modelling plastic is placed over the centre of the vibrating line so that it is about 4 mm. wide and about 1·0–1·5 mm. in thickness. The thickness will vary with the relative thickness of the soft tissues covering the bone in this region. With green modelling plastic softened, the tray is placed back in the mouth with a simple upward pressure. The patient is asked to open the mouth wide in order that the pterygomandibular raphe will be pulled forward against the softened material at the distal side of the hamular notch. Then the distobuccal angle of the buccal flange is softened, but the inside is left cold. It is softened on both sides and placed back in the patient's mouth. The patient is instructed to move his jaw from side to side. This will provide space for clearance for the ramus and masseter muscle on each side, and determine the thickness of the distal border of the buccal flange.

To complete the upper tray, the borders of the corrected preliminary impression are reduced 1·5 mm. in height by knife-trimming. Space for the final impression material is provided by scraping out 0·5 mm. from the entire inside surface except at the postpalatal seal. This portion of the tray will serve as a guide for seating the tray when the final wash impression is made. If the rugæ are prominent, 1·0 mm. or more of space is provided for them.

The final upper impression is made in Plastogum (a modified gypsum product). A uniform procedure for measuring, mixing, and handling this material is followed for each impression. The water and Plastogum are measured; the water is at 70° F.; the mechanical spatulation time is 45 seconds.

If the tray has been properly prepared, the impression will be satisfactory, with regularity. If the tray is not properly prepared, it is nearly impossible to make a satisfactory impression.

The final impression should have nicely rounded borders on the flanges, and should have a more or less uniform layer of Plastogum over the entire inside surface. The tray should not show through the Plastogum except at the postpalatal seal. In this area, the Plastogum should be quite thin, as the seating pressure should have displaced most of it.

Anatomy of the Mandibular Basal Seat.—When an impression is to be made for a mandibular denture, the anatomic structures that will surround the denture should be visualized as they exist and function under the mucous membrane (*Fig.* 3). These structures are equally important with the arch form, ridge shape, and the mucous membrane covering. The location and action of each structure must be considered if the denture is to function properly.

At the midline on the labial surface of the ridge, the labial frænum has no muscle underlying it. There is no muscle attaching the lip to the ridge in the labial vestibule.

The buccal frænum is located about the region of the first bicuspid, and under it is the triangularis muscle. This is a muscle of facial expression which is pulled backward by the buccinator muscle and forward by the orbicularis oris muscle. Provision for this action must be made in the buccal flange of the denture. The inferior attachment of the buccinator muscle is to the buccal shelf of the mandible in the molar region. The fibres of this muscle are placed horizontally. The anterior attachment is to the modiolus, and the posterior attachment is to the pterygomandibular raphe, with the muscle turning lingually in front of the ramus. The buccal flange of the denture rests upon the attachment of the buccinator muscle. The shape of the lower buccal vestibule is determined by it, the masseter which lies buccal to it, and by the ramus and body of the mandible.

The labial flange should be long enough to reach to the reflection and thick enough to restore the contour of the lower lip. The buccal flange should be wide enough to cover the buccal shelf of the mandible but not so wide as to push into the cheek. It should be shaped so its buccal surface faces out and up, in order that the cheek will fall in and rest on top of it. This design will provide a better border seal and greater usefulness to the denture.

The floor of the mouth anteriorly varies its position greatly with the contraction of the mylohyoid muscle. The mylohyoid muscles of the two sides join at the midline and form a cradle-like support for other structures in the floor of the mouth. Excessive protrusion of the tongue will develop a lingual flange that is too short and insufficient extension of the tongue will develop one that is too long. The flange should be developed so the tongue can touch the upper teeth when the mouth is open.

The mylohyoid (internal oblique) line slopes downward and forward from the lingual tuberosity. The lingual tuberosity is at the antero-posterior level of the front end of the retromolar pad and marks the posterior end of the mylohyoid ridge. The anterior end of the mylohyoid line is in the region of the second bicuspid tooth. The mylohyoid muscle attaches to the mylohyoid line, but the attachment extends about 1 cm. distal to the lingual tuberosity and nearly to the midline of the mandible anteriorly.

The mylohyoid muscle determines the *length* of the lingual flange anteriorly and it determines the *shape* of the lingual flange posteriorly. Obviously, these determinations are indirect because the muscle does not make *direct* contact with the mucous-membrane floor of the mouth at any place.

The attachment of the mylohyoid muscle is relatively high posteriorly and low anteriorly.

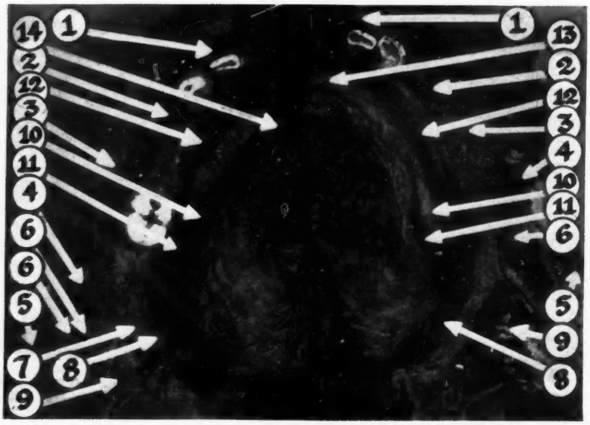

Fig. 3.—Limiting structures of the lower jaw. 1, Labial mucous membrane reflection. 2, Lower buccal frænum and triangularis muscle. 3, Buccal vestibule and buccinator muscle. 4, Buccinator muscle. 5, Masseter muscle. 6, Anterior border of the ramus and temporal tendon. 7, Pterygomandibular raphe. 8, Superior constrictor of the pharynx. 9, Internal pterygoid muscle. 10, Alveololingual sulcus. 11, Mylohyoid muscle. 12, Premylohyoid depression. 13, Floor of the mouth and anterior portion of the alveololingual sulcus. Note the characteristic "S" shape of the space for the lingual flange.

Therefore, if the denture flange is extended below the mylohyoid ridge, the flange must be approximately parallel to the angle of the mylohyoid muscle when the muscle is under contraction.

At the anterior end of the mylohyoid ridge, a depression or fossa may be observed. This may be noted as a bulge on impressions. From this "premylohyoid eminence" (on the impression) posteriorly, the lingual flange of the impression (and denture) must slope toward the tongue and away from the mandible. This will make it parallel to the mylohyoid muscle which will be free to contract without lifting the denture.

The lingual flange should be extended distal to the end of the mylohyoid ridge to the retromylohyoid curtain. The retromylohyoid

curtain is the back end of the alveololingual sulcus. This extension should turn laterally toward the ramus in the retromylohyoid fossa. It cannot be locked against the bone in this region because of the position of the posterior end of the attachment of the mylohyoid muscle. This part of the lingual flange will prevent the tongue from "noticing" the lingual flange, and prevent it from getting under the flange. The purposes of the extension are to guide the tongue on top of the flange and to complete the border seal. The lingual surface of the extension (the retromylohyoid eminence) faces in and down. If the lingual flange is designed in this manner, the posterior part guides the tongue on top of the part in the molar region. In this manner, the tongue helps to hold the denture in place.

The retromolar pad is the triangular pad of soft tissue at the distal end of the lower ridge. It is composed of fibres of the buccinator and superior constrictor muscles, fibres of the temporal tendon, fibres of the pterygomandibular raphe and palatal glands. These structures cannot tolerate excess pressure, so a posterior seal with extra pressure should not be made on the retromolar pad. However, the denture should be extended to cover the pad.

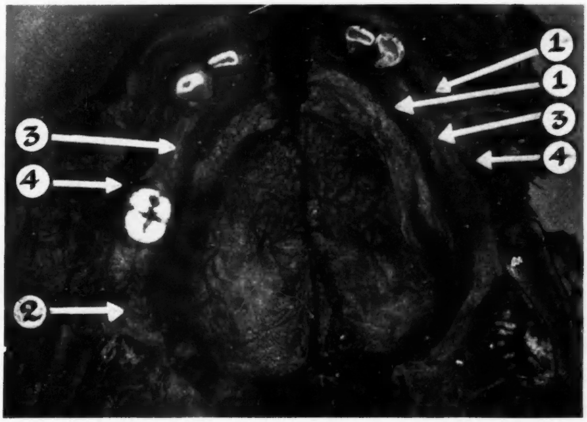

Fig. 4.—Supporting structures of the lower jaw. 1, Slopes of the ridge. 2, Retromolar pad. 3, Fibrous connective tissue covering the crest of the ridge. 4, Buccal shelf.

Denture Support.—Mandibles vary in their surface contour and in the type of surface on the residual ridge. A sharp bony ridge is unfavourable as is one that is rough or perforated with large nutrient canals. The absence of a good layer of cortical bone over the residual ridge can cause obscure and annoying "denture soreness". The buccal shelf is usually covered with good smooth cortical bone. The impression should be designed to make the maximum use of this favourable area. Roentgenograms make it possible to diagnose the bony foundation.

The soft tissues in the basal seat are similar to those over the maxillæ, but the bony contours and the condition of the bone make it necessary to plan the impressions for a different distribution of pressure than was done for the upper impression (*Fig.* 4).

Since the crest of the ridge is frequently unfavourable, the primary stress-bearing area is on the buccal shelf, and the crest of the ridge then becomes the secondary stress-bearing area. The valve seal area extends entirely around the denture with the borders ending in movable tissues.

Impression Technique.—When the impression is made, the anatomic structures underlying the mucous membrane should be

visualized. If this is done, much time can be saved, and the end result will accomplish the maximum benefit to the patient.

A stock metal tray which is oversize is selected, and a preliminary impression in black modelling plastic is made. The objective of the preliminary impression is bulk with which to work. There should be at least 6 mm. of thickness between the impression surface and the surface of the metal tray. The impression is removed from the tray and reinforced. The distance from the crest of the ridge to the reflections is observed and marked on the impression. The impression is knife-trimmed to these marks and the lingual flange is carved from the inside (the buccal surface) so that it slopes markedly toward the tongue in the region of the mylohyoid ridge. The outside of the impression is carved to the approximate shape of the denture.

The inside (impression surface) is heated, tempered, and inserted for the purpose of recording more detail of the mucous-membrane surface.

The buccal and labial borders are moulded by heating them a section at a time, and pulling the cheeks and lip over the top of the impression.

The anterior lingual flange is moulded by first heating the edge and having the tongue thrust out, then heating the lingual surface and having the tongue pushed hard against the hard palate.

The buccal surface of the lingual flange in the molar region is formed by heating it and having the tongue thrust out hard. If an undercut develops in this region, it should be removed with a knife before it is reheated and the process repeated. The usable length of the flange in the molar region will vary with the angle of the flange. The more nearly horizontal it is (within limits), the longer it can be. The edge of the flange in the molar region is heated and the tongue is thrust out to mould the border.

The edge of the distal end of the lingual flange is moulded in a similar manner. The sequence of border moulding is important because it limits the amount of change to be made in each region.

The part of the impression covering the retromolar pad is heated so the plastic material is quite soft. The mouth is opened wide, then closed, and downward pressure is applied on the impression. This will limit the pressure on the pad and provide clearance for the limiting structures around the pad.

The borders are shortened 1·5 mm.; 0·5 mm. is removed from the entire inside surface of the impression, except over the retromolar pad where at least 1 mm. is removed. A plaster-wash impression is made in this tray.

A vulcanite tray is made from the cast made in this impression. Three vertical handles are placed on the tray. The anterior handle is used to carry the tray to the mouth, and the posterior handles are placed over the first molar tooth positions.

The Final Impression.—The vulcanite tray is prepared for the final impression by removing the excess material and removing other material in areas where pressure is not desired. The borders are retained in the form that was determined by the plaster-wash impression. All undercuts are removed except at the retromylohyoid eminences. At least 1 mm. of the entire inside of the tray is removed with a vulcanite bur, except the parts to be in contact with the buccal shelf.

The buccal surface of the lingual flange is ground away so it slopes toward the tongue. When this is done correctly, the edge of the lingual flange on each side will have the shape of an "S" curve.

A zinc oxide and eugenol impression is made with the tray being held in position with a finger resting on each of the posterior handles. The tongue is held "against the upper front teeth" while the mouth is held wide open, and while the impression material sets. This will provide the proper contour of the lingual flange providing the tray was formed properly.

The impression tray should "show through" the impression material only in the regions of the buccal shelves. If it "shows through" at other places, the tray must be modified at these places and a second zinc oxide and eugenol wash impression is made after

removing the first impression except that part on the buccal flanges. If the borders of the tray are too long (as indicated by bare spots), these places should be modified before the second impression is made. Each modification, from the modelling plastic preliminary impression to the final impression, is made to develop a more accurate tray. The tray is the most important requisite for an impression.

SUMMARY

The relationship of the anatomy of the mouth to impression making has been discussed, and a technique for making impressions for complete dentures has been described. The principles used in the impression procedures are based upon the fundamental anatomy and physiology of the denture foundation and the other structures that surround the dentures.

PAIN AND THE INNERVATION OF DENTINE IN CAVITY PREPARATION

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PAIN elicited by various stimuli during cavity preparation is one of the major problems of conservative dentistry. Scratching or cutting with dental instruments, temperature changes, pressure, galvanic currents, or the application of chemicals to freshly cut or exposed dentine are common causes of painful sensations. The threshold of pain sensibility in the teeth varies from person to person. Contralateral teeth in the same dentition may differ in their reactivity to painful stimuli. Furthermore, teeth which are relatively insensitive when first treated may become more sensitive after treatment, and vice versa. The purpose of this paper is to give the histological background to this problem in the light of recent observations on the innervation of dentine (Fearnhead, 1957).

Controversy over the details of the neurohistology of dentine has contributed much to the uncertainty in dealing with pain caused by cavity preparation. There are two conflicting views on the innervation of dentine, one that dentine is innervated and the other that it is not. Among those who hold the latter view, some believe that apart from its function in the formation of dentine, the odontoblast is a special form of a sensory cell. Adherents to this theory believe that stimuli are received by the long processes of the odontoblasts (Tomes fibres) in the peripheral part of the dentine and transmitted to nerves which end in some form of synapse on the pulpal end of the odontoblast. This hypothesis, which has been erected on negative histological findings, originated from the work of Hopewell-Smith (1893) and has recently been supported by Phillipp (1955), whose views are based on the fact that he was unable to demonstrate nerve-fibres in the dentine after employing several silver impregnation techniques. Silver impregnation methods are known to be very difficult to control and it is significant that the methods used by Phillipp also failed to demonstrate the nerve-fibres forming the plexus of Raschkow which are normally quite easily stained with either methylene blue (*Fig.* 1) or silver methods. Furthermore, no one has yet satisfactorily demonstrated synaptic endings of nerves on the odontoblasts.

When unlined cavities are filled with self-polymerizing acrylic resin, odontoblast nuclei are often aspirated into the dentinal tubules. On the basis of a clinical and histological study, Kramer (1955) could find no correlation between the presence of aspirated odontoblasts in the dentinal tubules and pain experience during the insertion of the fillings, nor was there any correlation between pain and the period between filling and extraction. He concluded, therefore, that dentine sensitivity cannot be explained on the basis of movements of the contents of the dentinal tubules. In the light of these observations it seems unlikely that

the odontoblast is a special type of sensory cell directly concerned with the initiation of pain impulses.

Among those who provide the most convincing evidence that dentine contains nerve-fibres, the work of Tojoda (1934) is probably the best known. Many of the observations of this worker have recently been confirmed and very small nerve-fibres were demonstrated within the dentinal tubules (*Fig.* 2) by means of a specially controlled silver staining technique (Fearnhead and Linder, 1956). The amelo-dentinal junction is usually considered to be more sensitive than the deeper parts of the dentine; there is, however, a scarcity of literature on the neurohistology of this region. Intra-tubular nerve-fibres have so far been demonstrated approximately half-way through the thickness of the calcified dentine. This unfortunately leaves the question unsettled whether the peripheral portion of the dentine is innervated or not. The intra-tubular nerve-fibres that can be demonstrated are approximately 0·2μ in diameter, which is very near to the limit of resolution obtainable with the optical microscope. It is possible, therefore, that nerve-fibres too small to be resolved by optical methods are present in the dentinal

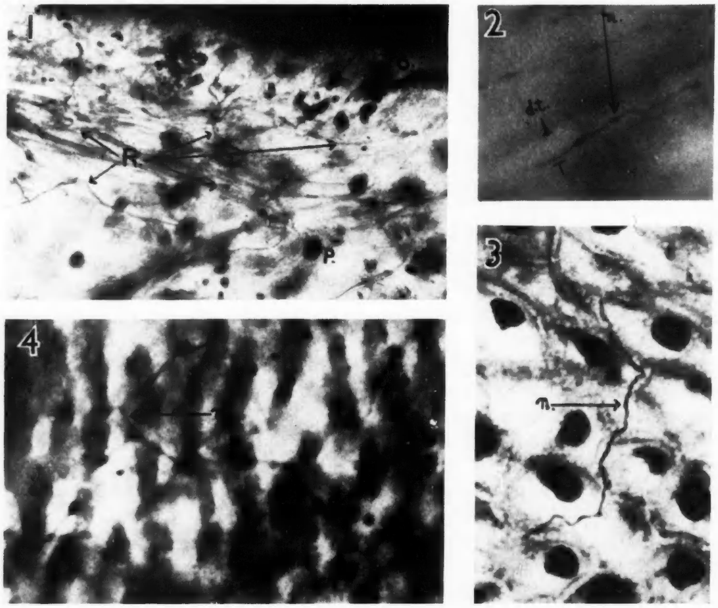

Fig. 1.—Thick longitudinal ground section of a human molar stained by an *in vitro* methylene blue method showing the ramification of nerve-fibres which form the plexus of Raschkow (R) on the pulpal side of the odontoblast layer. d, dentine; o, odontoblasts; p, pulp. (× 200.)

Fig. 2.—Intra-tubular nerve-fibre in human dentine. The arrow indicates one of the beads which are characteristic of small terminal nerve-fibres. Silver impregnation. n, nerve-fibre; d.t., dentinal tubule. (× 1500.)

Fig. 3.—Intra-epithelial nerve-fibre in the "prickle cell" layer of human skin. Silver impregnation. n, nerve-fibre. (× 1000.)

Fig. 4.—Section cut tangentially through the junction between predentine and pulp of a human molar, showing small beaded nerve-fibres of the marginal plexus lying on the surface of the predentine between the odontoblast processes. n, nerve-fibre. (× 1500.)

tubules close to the amelo-dentinal junction. Proof of this, one way or the other, might be obtained by carefully applied electron-microscopical methods.

For the present, however, because of the difficulty of obtaining adequate preservation of the contents of the tubules in the peripheral portion of the dentine, little histological data of a reliable nature exist.

On first consideration the presence of small nerve-fibres in very narrow calcified tubes, far removed from the nearest blood-vessels, seems to be unique. However, there is to some extent a parallel situation in the skin where considerable lengths of terminal nerve-fibres lie in the inter-cellular region between epithelial cells (*Fig.* 3). Furthermore, the pattern and morphology of nerve terminations in the pulp and dentine corresponds very well with that of sensory nerve-endings in the skin. For many years it has been accepted that in the skin the four primary modalities, cold, heat, touch, and pain, were each related to a special type of nerve-ending. In this theory of cutaneous sensibility, free naked axon terminals were believed to be responsible for the perception of pain. Recently, however, Weddell, Palmer, and Pallie (1955) have made a critical re-examination of this problem, and they have reached the conclusion that there is no convincing histological evidence that morphologically specific nerve-endings subserve each of the primary modalities of cutaneous sensibility. They suggest that nerve terminations should be studied from the point of view of their functions as transducers of stimuli (mechanical, thermal, or chemical) into propagated action potentials rather than on the basis of a morphological classification. These observations are of very great importance to the problems associated with the innervation of the pulp and dentine, since it is a commonly held view that when either heat, cold electrical current, chemicals, or traumatic stimuli are applied to dentine they all elicit pain, and that the nerves supplying the dental pulp and dentine cannot distinguish between these various types of stimuli. The complex overlapping of nerve-fibres at the periphery of the coronal pulp in the region of the plexus of Raschkow (*Fig.* 1) and the considerable amount of branching that occurs in the terminal fibres of the marginal plexus on the surface of the predentine (*Fig.* 4) may provide an anatomical explanation for this phenomenon, since the confusion of terminal branches in a confined area would tend to reduce discrimination to a minimum.

The clinician is more concerned with histological data which can guide him in the choice of methods for the practical control of pain, rather than controversial histological detail.

Many operators use local anæsthesia as a routine procedure in cavity preparation; others use some form of cold-water spray or a jet of cold air to reduce the amount of heat generated by the bur during cutting; and some use local anæsthesia in addition to a cooling device. There are a few, however, who make no attempt to ease the pain of cavity preparation since they prefer to use the patient's reaction as an indication of cavity depth and as a measure of tissue damage.

It is a commonly held view that a stimulus sufficient to produce pain is also sufficient to produce cell damage; consequently pain in the teeth, as elsewhere, gives warning of harmful stimuli. Unfortunately this is often misinterpreted as meaning that cell damage does not occur without pain, whereas in fact considerable cell damage can occur before the onset of pain. Support for this has recently been provided by an experimental study conducted by Marsland and Shovelton (1957), who conclude that damage may occur to the pulp in the most carefully prepared cavities, although use of an efficient cooling device considerably reduces the thermal factors of damage in cavity preparation.

It is possible that the release of substances resulting from cell damage play an important and independent role in the initiation of pain. These factors, which might possibly have some role in the initiation of pain impulses, need careful study. Useful study on this aspect of the problem is severely handicapped for the present by a lack of detailed knowledge of the fine structural components of the dentinal tubule and its contents. It is reasonable

to expect, however, that even in the most carefully prepared cavity, an area of trauma, caused by vibration, heat, and the chemical breakdown products from the odontoblasts, precedes the advancing face of the floor and walls of the cavity.

Areas of "dead tracts" in the dentine and secondary dentine are generally regarded as being insensitive and more often than not cavities may be cut into these regions without arousing painful sensations. It is of interest, therefore, that tubular secondary dentine may sometimes be innervated in the same way as primary dentine. Furthermore, nerve-fibres may occasionally become enclosed in non-tubular secondary dentine close to the pulpal surface, although it is not known whether they survive in this situation.

In conclusion, the presence of small nerve-fibres in the dentinal tubules provides an anatomical basis for the sensitivity of human dentine. The physiological mechanism involved in the induction of pain in these fibres by various stimuli, however, still remains to be elucidated. Howard (1957) has recently described the results of applying various solutions to freshly exposed dentine. In the majority of his patients he was able to elicit pain by the application of sugar solutions to the floor and walls of the cavity, whereas in only a few patients was a similar response obtained after the application of a known pain-producing substance, acetylcholine, although acetylcholine is known to produce a painful response in sensory nerves elsewhere in the body. These observations are of considerable importance to the problems of dentine sensitivity, and it is hoped that the physiological approach to this subject along these lines will be continued.

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Impressions for Indirect Inlays

Elasticity is an essential property of an impression material used in the indirect technique. This is to allow accurate reproduction of the undercut areas which are always present just outside those cavity margins which are below the survey line.

Reversible hydrocolloid and rubber base impression materials are elastic and both are discussed, with the emphasis on rubber base.

Various practical points for using rubber base materials are enumerated: (1) Impression trays are favoured and copper rings are not. This is because the container must be stiff enough not to elastically distort while inserting the impression and yet have a high elastic limit to return to its original shape if distorted on withdrawal. (2) Clearance of 3 mm. between container and tooth is recommended to allow compression of the material without strain when withdrawing. (3) Adhesives must be used to keep the material tightly in the tray. (4) " Snap " withdrawals are unnecessary. (5) Profound anæsthesia is recommended to reduce salivation and to allow retraction of the gingivæ. (6) All gingival margins must be exposed. Gingivæ are compressed with string soaked in adrenaline. (7) Combined impressions, using impression compound and then a coating of rubber base, are unstable. (8) The rubber base is introduced into the cavity or cavities with a type of Jiffy tube or else a special syringe. The cavity is filled from the bottom up to avoid air bubbles. The tray also filled is then inserted. (9) At least ten minutes should be allowed from the start of mixing to the time of withdrawal. (10) No inaccuracy occurs even if the casting of the model is delayed several days. A second model can be made from tray impressions. (11) Additions of rubber base to deficient impressions is not satisfactory. (12) Any roughness on adjacent teeth or fillings should be coated with cocoa butter prior to impression taking.—STURDEVANT, C. M. (1957), *J. Amer. dent. Ass.*, **54**, 357.

A PROTECTIVE SHIELD FOR USE IN THE DENTAL LABORATORY

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and **H. M. OLDFIELD**
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In a dental laboratory where varying forms of grinding procedures are being carried out it is desirable that some form of protection be afforded to the operator and others working in the vicinity. Protection is necessary against both small and large flying fragments which are liable to hit the face from any angle and at high velocity. The fragments may be of plastic material, metal, or abrasives from the stones being used.

METHODS OF PROTECTION

The method of protecting the technicians in the laboratory will be dependent on the type of grinder that is used. If all the grinders are fixed to the bench, then adequate protection can be provided, not only to the operator but to others working in the vicinity, by means of hoods placed over the operating areas (*Fig.* 1). These are constructed in a transparent material with sufficient impact strength to resist fracture. Perspex is usually used in preference to the more expensive armour-plated glass.

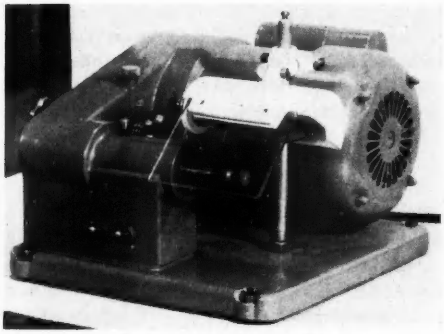

Fig. 1.—Protective hood on fixed grinder.

In finishing a chrome-cobalt denture base many technicians prefer a high-speed motor such as the Desoutter Model O grinder, driven by compressed air and capable of a speed of 75,000 r.p.m. With such a grinder the operator holds the piece of work in one hand and carries the motor to it with the other. Many forms of protection have been designed and advocated for this and similar industrial procedures. The protector, if of the type worn by the operator, must permit the work to be carried out in absolute safety and comfort with unimpaired vision; it must be adequately ventilated, resistant to chemical attack, and, of course, non-irritant to the wearer. The material should have a high impact strength, be resistant to abrasion, and be readily cleaned.

Fig. 2.—The "Panorama" face shield.

The Panorama Equipment Ltd. have produced a number of such shields. Goggles are available, but these have the disadvantage of incomplete coverage of the facial tissues. The "Panorama" face shield (*Fig.* 2) has been used by technicians working in our laboratory. It weighs 190 g., does not touch the face, and there is no interference with vision or free air

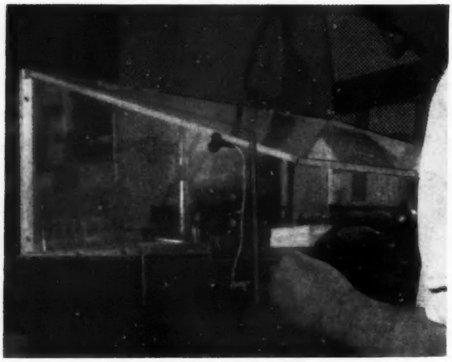

Fig. 3.—Portable guard in use.

circulation. The visor is of moulded polyvinyl chloride and the window consists of cellulose acetate, which is tough and resilient and is easily removable and replaceable. The head harness is adjustable and incorporates a sweat band. Nevertheless, working in a small laboratory where the temperature in summer may be as high as 100° F., the technicians have complained of the shield feeling heavy and uncomfortable after a period of prolonged wear. The main disadvantage is, of course, that only the *operator* is protected—the other technicians in the laboratory are exposed to injury unless they wear a face shield at all times. This is naturally a most unsatisfactory arrangement.

The alternative to this type of protective shield is for the operator to work with both hands under a transparent guard. Such a guard has been designed and is now in routine use at the Liverpool Dental Hospital (*Fig.* 3). Because of the restricted bench space available, it has been made portable, but is sufficiently solid to maintain its position on the bench. The guard is constructed in perspex and attached to a synthetic wood base. The top is hinged and adjustable and can be raised or lowered to suit the operator. The side panels ensure that workers on each side of the operator are safe from injury, as also are those directly in front. There is no restriction to vision.

The perspex will tend to become scratched by small particles of metal or abrasive, and to ensure that vision remains perfect it is necessary to clean the perspex at regular intervals. The Plastics Division of Imperial Chemical Industries in a personal communication recommends the use of a series of polishes:—

No. 1 is a very mild abrasive in a suitable liquid form. Similar results to those obtained with this can be obtained by using a good quality brass polish.

No. 2 is a mixture of oils so designed to have the same refractive index as perspex, so that minute scratches filled with this oil will not show and therefore a high surface polish will be observed.

No. 3 consists of a sulphonated fatty acid with a small quantity of a suitable antistatic agent.

The use of an anionic detergent may produce a charge on the surface of the perspex which would result in dust particles being attracted to the surface; the antistatic agent is introduced to mitigate this effect.

SUMMARY

A portable protective shield has been designed which is suitable for use wherever a hand-operated grinder is in use.

Acknowledgement.—The authors wish to thank Mr. S. Bailie for the photographs.

Chrome Alloy and its Adaptation to a Molar Band Technique

A detailed description of a technique of molar band construction in stainless steel is given. A list of instruments required, the use of a spot welder, and simple diagrams illustrating each stage are included.—Boone, G. N. (1957), *J. Dent. Child.*, **24**, 45.

RECURRENT APHTHOUS ULCERS*

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THE *Oxford English Dictionary* defines the word "aphtha" as the "infantile disease 'thrush'", but the condition which is now described as recurrent aphthous ulceration of the mouth is not thrush. It was first described by von Mikulicz and Kümmel in 1898 and again by Sibley in 1899. Sircus, Church, and Kelleher (1957) found that the lack of knowledge of the condition and its treatment has led to the use of no less than twelve synonyms including Mikulicz ulcer, dyspeptic ulcer, canker sore, periadenitis mucosa necrotica recurrens, and fragmentary Behçet symptom complex.

It has been known for some time that the incidence of recurrent aphthous ulcers in the general population is fairly high, and recently Sircus and others (1957) in a survey of 1738 patients attending for treatment of other complaints at hospitals in Sheffield and Edinburgh found that 20·1 per cent, or approximately 1 in 5, suffered from these recurrent ulcers at some period in their lives. The incidence among females was found to be 1 in 4 while that in males was 1 in 6. Although the onset of the ulcers is usually during the first three decades of life, it was considered that there was a significantly higher incidence of onset among women than men in the 50–59 age group.

The investigations of Löblowitz (1910), Strandberg (1918), and Pappworth (1941) indicate that there is a familial tendency, and Sircus and others (1957) found that where one or more parents were affected the ulcers appeared to start in the children at an earlier age than in their parents.

There is little evidence that the condition is contagious and although several authorities have supported the view of Lipschütz (1923) that *Bacillus crassus* is the causative organism, the possible close relationship of this bacillus to *Lactobacillus acidophilus* (Bergey, 1948) indicates that it may be a secondary invader. Kilbourne and Horsfall (1951), Kerr (1952), Cahn (1950), and others consider the *herpes simplex* virus to be the cause of the ulcers. On the other hand, Dodd and Ruckman (1950) and the careful work of Blank, Burgoon, Coriell, and Scott (1950) and Balducci, Stuart-Harris, and Tyrrell (1956) indicate that the *herpes simplex* virus plays no aetiological role in these recurrent aphthous ulcers.

Although no definite exciting cause has been found, precipitating factors which have been cited include financial worries (Sibley, 1899), severe emotional and environmental stress (Sircus and others, 1957), allergy, endocrinal disturbances, and trauma.

Concomitant ulcers, similar to those found in the mouth, have been described on the scrotum (Strandberg, 1918; and others), and on the vulva by Ravell (1932). Behçet (1937) described cases with ulcers involving the mouth, genitals, and skin, and also the mouth, genitals, and eye. A review of 274 cases by Touraine (1941) and the work of others who indicate the association of these oral ulcers with other conditions is well summarized by Sircus and others (1957).

Cahn (1936) considered that the lesions start as the result of intra-epithelial œdema with the formation of a vesicle. The vesicle is rarely seen and rapidly breaks down to form an ulcer with no specific characteristics. Touraine (1941) considers that there may be an arteriolitis of the deeper vessels in the underlying dermis followed by a secondary necrosis of the epithelium.

In this present work 121 patients (80 females and 41 males) with recurrent aphthous ulceration of the mouth were examined. The clinical examination included the patient's personal and family history, the history of the oral ulcers and concomitant ulcers elsewhere, the possible precipitating factors, and the effects of treatment. The possibility of a specific bacterial and viral cause was investigated and the histopathological changes were examined.

* Presidential address at the commencement of the Ninth Annual Session of the British Society of Periodontology held on Oct. 14, 1957.

2

In view of the apparent relationship between the inability to secrete the blood group antigen and the incidence of duodenal ulcers reported by Clarke, Edwards, Haddock,

Fig. 1.—A typical moderately large aphthous ulcer on the buccal mucosa showing the reddened but not raised margin.

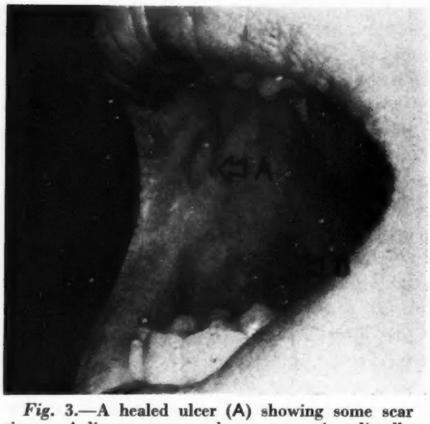

Fig. 3.—A healed ulcer (A) showing some scar tissue. A linear scar can be seen running distally along a line corresponding to the occlusal plane. Two small ulcers (B) are also present.

Howell-Evans, McConnell, and Sheppard (1956) it was decided largely at the suggestion of Dr. C. A. Clarke and Dr. R. B. McConnell that patients with recurrent aphthous ulcers of the mouth should be similarly investigated.

CLINICAL FINDINGS

During the development of the individual ulcer the lesion is first noticed as a prickly or burning sensation on the mucosa which

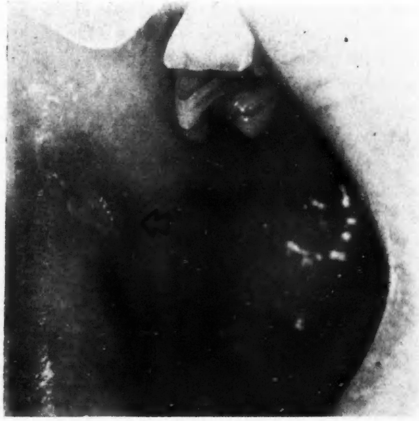

Fig. 2.—An ulcer similar in size to that seen in *Fig.* 1 with raised and reddened margin.

becomes reddened. In some patients a greyish white plaque is formed which is lost within a few hours. Within 24 hours the centre of the area breaks down to form a small ulcer which gradually increases in size for 3–6 days. The ulcer is usually painful, sensitive to movement of the tissues and to irritants. It appears anywhere on the oral mucosa and on the tongue as a shallow ulcer with a grey-yellow base and red surround, the size ranging from that of a pin head to up to 2 cm. in diameter (*Fig.* 1).

The form of the outline frequently depends on the site—those appearing on flatter surfaces being usually rounded while those in the buccal and labial sulci are usually more elongated. When the lesion is of long standing it frequently becomes deeper and the margin may be raised and rolled (*Fig.* 2). Usually the healing starts after about 6 days and is complete within 10–14 days. Occasionally however, as in three cases examined, individual ulcers lasted for as long as 6 weeks.

The designation periadenitis mucosa necroticans recurrens (Prinz and Greenbaum, 1944) was considered to be applicable to those ulcers

that are deep and heal with the formation of a scar (*Fig.* 3). From the examination of the patients considered in this paper, scar formation was uncommon and usually appeared in those sites that could be easily damaged by the teeth. Other ulcers appearing in the same patients usually healed without scar formation (*Fig.* 3).

At any one time only a single ulcer may be present, but in most of the cases examined there were two or three, and in one case as many as twenty-two. Even in the severe cases, the patients had no rise in temperature and felt well except for the inconvenience of a sore and painful mouth.

Table I.—Showing the Frequency of the Recurrence of the Ulcers in 41 Males and 80 Females

Sex	Regular	Irregular	Continuous
	per cent	per cent	per cent
Male	20	60	20
Female	28	37	35

Occurrence of Ulcers.—The frequency with which the ulcers recurred among the 41 males and 80 females is shown in *Table I.* It seems from these results that males are more likely to have the ulcers at irregular intervals while the number of females was fairly evenly divided between the three classified groups. Forty-three per cent of the males and 40 per cent of the females classified as having regular or irregular ulcers were getting recurrences of the ulcers within one month. About twice the proportion of males to females had ulcers at irregular intervals of over three months.

Time-lag between Onset of the Ulcers and the Ulcers becoming Severe.—Twenty-six males (61 per cent) and 67 females (84 per cent) stated that at first the ulcers were small and occasional and became severe and more frequent after a period of time varying from a few months to several years. A case was judged to be severe when the ulcers were either deep and large and/or multiple. *Table II* recording the percentage distribution in each sex shows that both sexes had a similar history and about 50 per cent of both males and females who developed severe lesions did so within one year of the onset of the ulcers.

Table II.—Showing the Time-lag between the Onset of Ulcers and the Onset of the Severe Lesions

Time-lag before Ulcers become Severe	*Male* per cent	*Female* per cent
Within 1 year	50	52
1–15 years	38	35
16–45 years	12	13
Total number	26	67

Age Incidence.—In view of the time-lag between the age of onset of the ulcers and the age that they started to become severe, it was thought to be of interest to record these ages separately. This is shown in *Table III.*

It can be seen from this table that the more common age of onset in the female was during the first two decades, the lesions becoming severe in the second and third decades, while in the males the ulcers started and also became more severe in the first and third decades of life.

Table III.—Showing Age of Onset of Ulcers in Males and Females

	Age Groups	Males		Females	
		All Cases	Severe Cases	All Cases	Severe Cases
		per cent	per cent	per cent	per cent
Age of initial onset	0–10	43	50	33	43
	11–20	12	11	32	30
	21–30	38	30	12	10
	31–40	5	5	12	12
	41–50	0	0	6	5
	51–60	2	4	5	0
Age of onset of severe lesions	0–10		24		15
	11–20		18		32
	21–30		42		28
	31–40		0		18
	41–50		8		4
	51–60		8		3
Total		41	26	80	67

If the early age groups were split up into five-year groups it was found that while 61 per cent of males start having ulcers before the age of 15 only 48 per cent of females fell into

this group. Again, while no males were recorded with onset between the ages of 15 and 20, this five-year age group contained 25 per cent of females.

These findings may indicate that the onset of the condition is not influenced by the endocrinal changes associated with puberty. Unfortunately the number of males and females seen over the age of 45 was too small to justify any comment about the influence of the menopause on the onset of the ulcers.

Table IV.—COMBINED RESULTS OF SIRCUS AND OTHERS (1957) AND THE PRESENT WORK SHOWING THE RELATION BETWEEN SEX AND AGE AT ONSET OF APHTHOUS ULCERATION

Age at Onset	*Percentage in each Age Group*	
	Female	*Male*
0– 9	22	26
10–19	30	30
20–29	19	25
30–39	13	12
40–49	9	5
50–59	7	2

The probable lack of sex influence in the under forties is substantiated when the results of this work are combined with those reported by Sircus and others (1957). The numbers examined by these workers (40 males and 80 females) are almost exactly the same as those reported here. When the numbers in each age group are combined together as in *Table IV*, the percentage of males and females in each group is almost exactly the same up to the age of 40. Thereafter, the numbers are probably too small for any significant observations to be made.

Family History.—Sixty-two of the patients were married, but only 11 consorts (1 wife and 10 husbands) were known to have the ulcers and only 1 of each sex was thought to have started having the ulcers after marriage. It was found that 39 per cent of the patients had relations (either siblings or parents) affected with ulcers.

Although these two findings may indicate that heredity may play a more important part than contagion in this condition the 39 per cent may be a chance distribution where the incidence in the general population is 1 in 5.

History of Herpetic Infection.—Forty-four patients had a history of cold-sores and twelve had a known history of having had acute herpetic stomatitis. The ulcers in these particular patients were clinically indistinguishable from those seen in the patients without a history of herpetic infection.

Ulcers Elsewhere.—Nine patients had concomitant vulval ulcers and 1 had conjunctivitis. Thirteen females and 2 males had erythematous skin rashes, 4 of these had a history of allergy to lanolin, wool, domestic animals, and ivy.

Twelve patients other than those with a known history of hypersensitivity were tested for sensitivity to the common food allergens with no positive result.

Precipitating Factors.—Eighty-three cases had no history of any specific precipitating factor. Twenty-six females and 12 males thought that some factor would cause or was associated with the onset of the ulcers. These are shown in *Table V.* Although 23 patients stated that damage to the mucosa with the tooth-brush or biting the cheek brought on the ulcers, they all found that ulcers also developed with no previous history of trauma.

Table V.—SHOWING THE FACTORS POSSIBLY ASSOCIATED WITH THE ONSET OF ORAL ULCERS

Associated Factor	*No. of Patients*
Trauma	23
Mental stress	6
Menstruation	8
Menopause	1
Hysterectomy	1
Other factors	9

Other factors included eating walnuts or boiled sweets, mental strain, overwork, illness of parents (usually associated with overwork), and the stress of life after pregnancy. On the other hand, 5 cases considered that their ulcers were reduced in severity during pregnancy.

TREATMENT

The following treatments were tried, and the results assessed by the patients' reactions to the treatment:—

1. Sodium thiosulphate 10 mg. t.d.s.
2. Aneurine hydrochloride 25 mg. t.d.s.
3. Folic acid 5 mg. t.d.s.
4. A combination of (2) and (3).
5. Vitamin B complex forte.
6. Topical hydrocortisone in concentrations of 1 per cent and 2½ per cent.
7. Delta-hydrocortisone, 5 mg. t.d.s. for one week, 5 mg. b.d. for one week, and when improvement resulted a maintenance dose of 5 mg. per day.
8. Local treatment with aniline dyes, silver nitrate, and iodine.
9. Influenza vaccine therapy.
10. No treatment.

Treatments with sodium thiosulphate, vitamin B complex, and local application of aniline dyes, etc., had little or no effect in preventing recurrence, although the use of 1 per cent gentian violet and also silver nitrate if applied early was reported to cause the lesions to heal more rapidly on the first few occasions.

Neither aneurine hydrochloride nor folic acid by themselves had any obvious effect, but when combined together 13 cases out of 29 showed much improvement and 6 showed a temporary improvement. When the treatment stopped, the ulcers usually recurred within 1–3 months, but usually in not such a severe form.

Delta hydrocortisone, when dissolved in the mouth before swallowing, produced a dramatic result in 5 cases, but the ulcers returned within a few months. Topical hydrocortisone produced a good result in 2 cases and an improvement in 4 out of 14 cases. Vaccine therapy used in 6 patients was temporarily effective in 4 cases.

The results of Sircus and others (1957) summarize the general effects of treatment. These workers found that the results of placebo treatment was almost as effective as any medicament. It appears from these observations that the manner with which the treatment is given is probably as important as the drug used.

LABORATORY INVESTIGATIONS

Bacteriological examination on 80 cases revealed no constant bacterial finding.

An attempt to isolate the *herpes simplex* virus by inoculating fertile hen eggs with scrapings from the early lesions of 35 cases was unsuccessful. It was not possible to grow any other virus from these lesions using this medium.

Other attempts to isolate a virus from these lesions included the use of tissue-culture, notably of human amnion cells and fragment cultures of gingival tissue. Culturing was carried out in test-tubes in a slowly rotating drum as described by Feller, Enders, and Weller (1940) using a culture medium containing 50 per cent human serum, 40 per cent Hank's solution, and 10 per cent tryptic digest broth. So far, only 10 cases have been tried using human amnion cells, all with negative results after four weeks' cultivation at 37° C.

Table VI.—Showing the A.B.O. Blood Group Distribution among the Ulcer Patients and Controls

Blood Groups of Ulcer Patients	No. of Patients	No. of Patients	No. in Control Series (Clarke and others, 1956)
		per cent	per cent
A	42	34·4	39·1
AB	1	0·8	2·5
B	12	9·9	9·5
O	67	54·9	48·9

Blood Examination.—Although 5 patients with a low hæmoglobin were found to have ulcers in the mouth, these were excluded from the series as their history was not considered typical of recurrent aphthous ulceration. All of 45 other patients with a typical history of oral ulcers were found to have a normal blood-picture.

Fig. 4.—A section showing the changes seen in the epithelium in 8 cases. The vesicle found in this case has an irregularly thickened cap while the epithelium at the base of the vesicle is flattened. The underlying connective tissue is normal. (H. and E.) (× 24.)

Samples of saliva were taken and immediately placed in boiling water for ten minutes to destroy the enzymes that might affect the A.B.L. antigens, and stored at −20° C. The technique used for determining the presence of the blood group antigens in the saliva was the agglutination-inhibition test described by Clarke and others (1956). Serial dilutions of saliva were mixed with antiserum and after ten minutes the appropriate red cells were added. In non-secretors the antiserum is not affected and agglutination takes place. Extracts of the seeds of *Ulex europeus* were used as a source of anti-L.

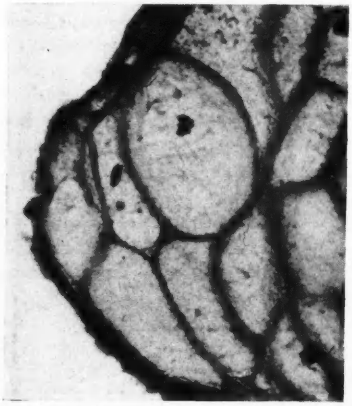

Fig. 5.—Higher magnification of the epithelial cells adjacent to the vesicle seen in *Fig.* 4. The granular appearance of the cytoplasm, the remains of some of the nuclei, and the thickened walls of the cells can be clearly seen. (H. and E.) (× 240.)

Table VII.—The Incidence of Non-secretors among Patients with Recurrent Oral Ulcers

	No. of Ulcer Patients	Non-secretors	No. of Ulcer Patients	Non-secretors	Control (McConnell, 1957)
		per cent	per cent	per cent	per cent
Males	41	29	52	27	23·4 (326)
Females	80	20	89	23·6	23·9 (351)
Both sexes	121	22·4	141	24·9	23·65 (677)

Secretion of A.B.O. Antigens in the Saliva.—The A.B.O. blood group of all patients was determined, and the results recorded in *Table VI* show that the blood group distribution among the patients with aphthous ulcers is very similar to the control group.

Although the percentage of male non-secretors among the patients with aphthous

ulcers is slightly higher (29 per cent) than the percentage in the controls (23·4 per cent) this cannot be regarded as a significant difference in the relatively small number of patients examined. When an additional 20 ulcer patients are included in the group it can be seen in *Table VII*, columns 4 and 5, that the percentage of male non-secretors is reduced to 27.

Fig. 6.—A section of an extensive ulceration of the buccal mucosa involving a sebaceous gland. An unaffected gland can be seen on the right of the section. (H. and E.) (× 24.)

When the numbers of both male and female patients are added together the incidence of non-secretors among patients of both sexes with recurrent oral ulcers is similar to that found in the control series.

Histopathology.—Biopsy examination was carried out on what were considered to be early lesions on the buccal and labial mucosa in the 31 patients. The tissue reactions were divided into four categories:—

1. Non-specific ulceration seen in 20 patients.

2. In 8 cases there was thickening of the epithelium produced mainly by enlargement of the individual cells of the outer layers (*Fig.* 4). The enlarged cells had thickened eosinophilic membranes with complete loss of the intercellular bridges and contained a granular material together with small remnants of the nucleus (*Fig.* 5). In 4 of these cases what was probably a vesicle with an irregularly thickened outer wall could be seen. The epithelial cells at the base of the vesicle were compressed (*Fig.* 4) and the underlying connective tissue was normal.

3. In 2 cases an extensive inflammatory reaction was found in association with sebaceous glands in the mucosa (*Fig.* 6).

4. In 1 case small abscesses were found deep in the connective tissue near to an otherwise non-specific ulceration of the oral mucosa (*Fig.* 7).

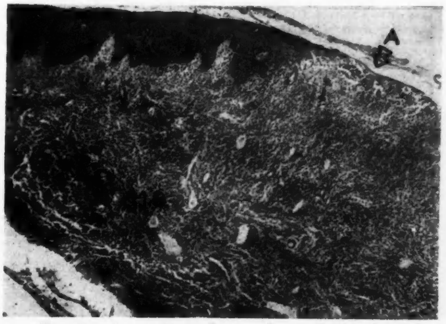

Fig. 7.—A section of an ulcer of the buccal mucosa (A) with a rounded abscess (B) situated deep in the connective tissue. Several of these abscesses were present throughout the connective tissue. (H. and E.) (× 24.)

It seems from the observations on the second type of lesion that vesicle formation is found in some of these typical cases of recurrent aphthous ulceration but the significance and relationship of the changes described are at present undecided.

DISCUSSION

It has been reported by Sircus and others (1957) that the incidence of recurrent oral ulcers is greater in women than in men, and also that there is a more marked rhythmical periodicity of the recurrences in females than in males. This present investigation confirms that males tend to have ulcers at irregular intervals whereas in females there is little difference between the number who have ulcers continuously, at regular intervals, or at irregular intervals. From the small number of patients examined in this investigation there is insufficient evidence to decide whether or

not the condition is influenced by the sex of the individual.

The aetiology of the recurrent aphthous ulcer is still very uncertain. The small number of consorts affected, together with a possible familial tendency, indicates that heredity may play a more important part than contagion. This would certainly be worth investigating further, but it would be difficult to exclude the influence of environment. The association of the formation of the ulcers with certain factors may indicate that ulcer formation is a reaction to general stress, be it physical or mental, local or general. This could only be shown negatively by investigating sibships. However, this does not exclude a specific viral or bacterial cause as it will be recalled that the formation of cold sores is frequently precipitated by conditions of stress.

Unfortunately, the possibility of isolating a virus from these lesions is made more remote by the difficulty of finding a suitable culture medium and the recognition of viral growth should it occur. In a medium such as the mouth the confirmation that the virus was the cause of the ulcers would require careful verification, particularly when there is little clinical evidence that the condition is infectious.

SUMMARY

One hundred and twenty-one patients with recurrent aphthous ulcers were investigated. The clinical condition, family history, age of incidence, and the influence of sex was discussed.

No specific bacterial or viral cause could be found in the limited number of cases tested.

Among patients with aphthous ulcers the incidence of non-secretors of the blood group antigens in the saliva was found to be normal.

The histopathology of the early lesion was described.

Acknowledgements.—The writer is indebted to Dr. C. A. Clarke for suggesting the secretion investigation and particularly to Dr. R. B. McConnell and his assistant Miss Sheila M. Manning for carrying out this part of the work. He would also like to thank Dr. W. Sircus and the Editors of the *Quarterly Journal of Medicine* for permission to use the figures in *Table IV*, Dr. B. Macaulay for carrying out some of the allergy tests, and the many medical and dental practitioners who kindly referred the patients without whom this investigation would not have been possible.

The photomicrographs were kindly done by Mr. W. Ley, of the University of Liverpool Photographic Department, and the clinical photographs by Mr. J. S. Bailie, of the Photographic Department of the School of Dental Surgery.

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An Appraisal of Two Relationships Proposed for Use in Orthodontic Diagnosis

An investigation of 100 North American white children was undertaken to discover the relationship, if any, (1) between the bizygomatic width and the bimolar width, and (2) between the bizygomatic width and the width of the permanent upper incisors.

Neither was found to function effectively as a diagnostic measure.—HIXON, E. H., and MEREDITH, H. V. (1957), *Amer. J. Orthodont.*, **45**, 286.

THE TREATMENT OF ANGLE'S CLASS II, DIVISION 1 AND CLASS II, DIVISION 2 IN IDENTICAL TWINS*

By H. L. LEECH, B.D.S., F.D.S., D.Orth.

In February, 1955, I read a short paper to this Society in which I described the skeletal and soft-tissue morphology and behaviour of these interesting twins, one with a typical Angle's Class II, division 1 malocclusion and the other with a typical Class II, division 2 malocclusion (*Figs.* 1, 2). It was seen that the main difference between them was the position of the upper central incisors, the proclination in the former and retroclination in the latter being attributed to their respective relationships to the soft tissues, especially the lower lip.

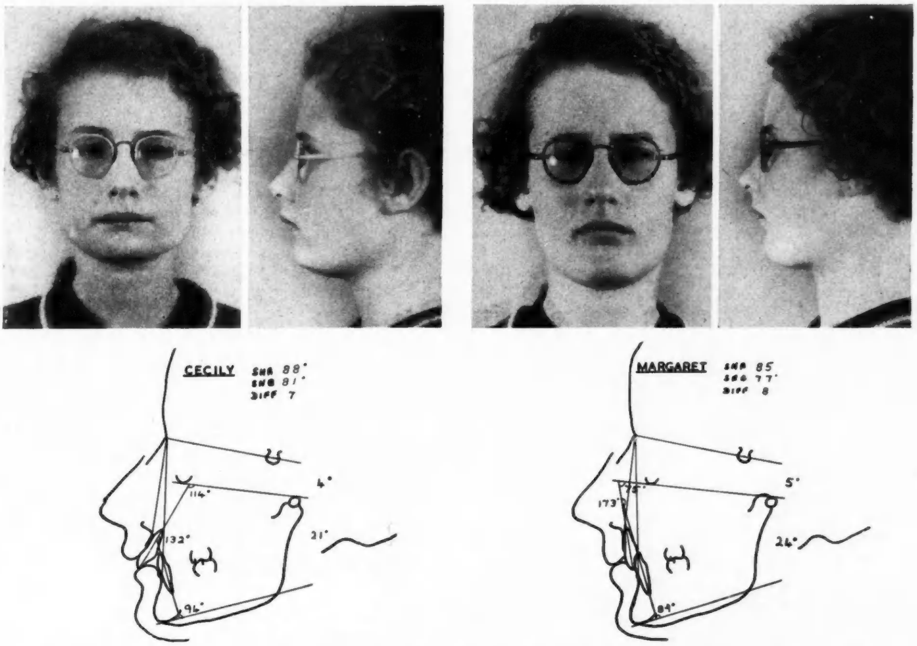


Fig. 1.—Photographs and tracings of Cecily (div. 1) and Margaret (div. 2, with teeth slightly open). Note the relationships of $\underline{1|1}$ to the lower lip.

Both twins had slightly incompetent lips and contracted them on swallowing, the twin with the Class II, division 1 malocclusion with the lower lip contracting behind the upper incisors and with an associated slight tongue thrust. The other with the Class II, division 2 malocclusion had the lower lip contracting over the upper incisors forcing the centrals back to the post-normal lower arch. In neither case was there a history of thumb-sucking.

The orthodontic treatment was very similar in each twin in order to achieve as near an identical result as possible within the bounds of soft-tissue behaviour.

* Read at the meeting of the British Society for the Study of Orthodontics held on Oct. 14, 1957.

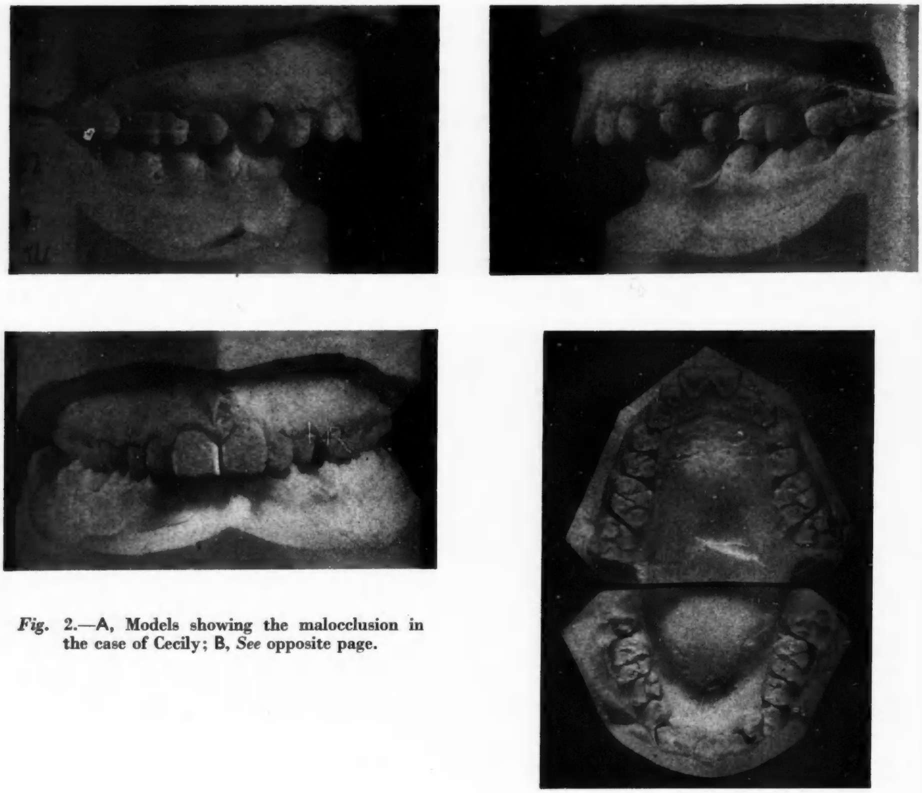


Fig. 2.—A, Models showing the malocclusion in the case of Cecily; B, *See* opposite page.

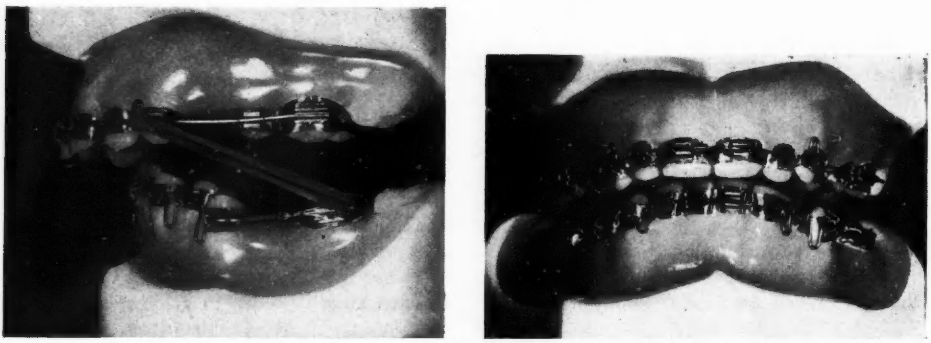


Fig. 3.—A, Showing the appliances used in the case of Cecily (div. 1); B, *See* opposite page.

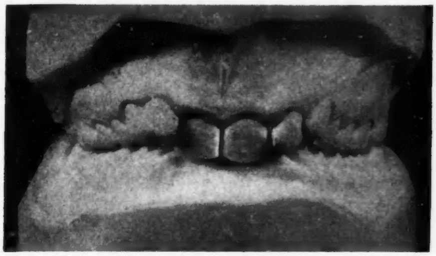
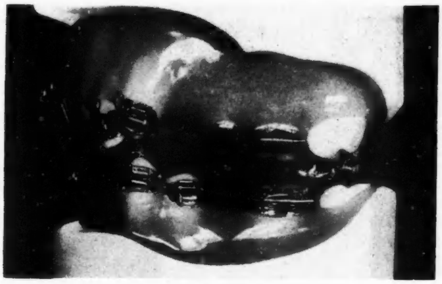
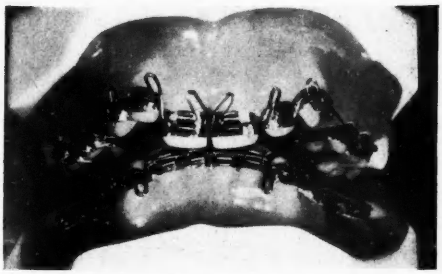


Fig. 2.—B, Showing the malocclusion in the case of Margaret.





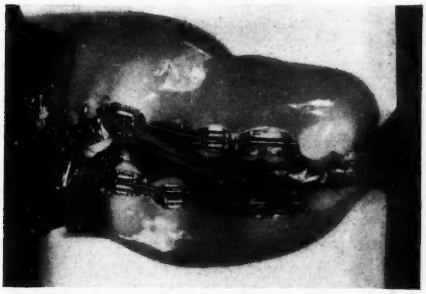


Fig. 3.—B, Showing the appliances used in the case of Margaret (div. 2). Note both the inter- and intramaxillary traction with elastics and coiled springs, and the Begg type of arch-wire for palatal root torque of the upper incisors.

At first, the treatment of Cecily (div. 1) consisted of slight anteroposterior expansion in the lower jaw with a lingual arch wire, with the intention of relieving the slight crowding and at the same time helping to reduce the incisor overjet. It was soon realized, however, that the resultant over-proclination of the lower incisors would not be stable in soft-tissue balance. The correct treatment to relieve this crowding and to reduce the incisor overjet necessitated the extraction of two teeth in each jaw, followed by retraction of the upper anterior teeth.

With Margaret (div. 2), after the initial fitting of a bite-plate, it became evident that similar extractions were necessary to relieve the crowding and reduce the overbite. Consequently $\frac{4|4}{5|5}$ were removed from both twins and intermaxillary traction with multiband appliances instituted (*Fig.* 3).

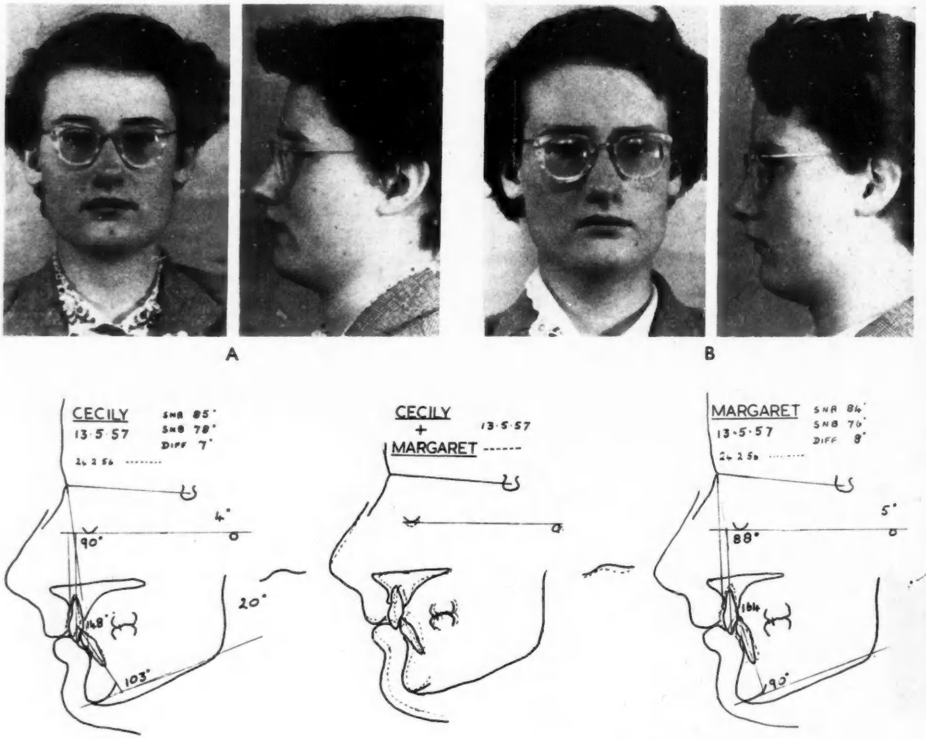


Fig. 4.—Final photographs and tracings of Cecily (A) and Margaret (B). The dotted outlines are the incisor positions on removal of retention appliances. Final composite tracing of Cecily and Margaret showing the more distal position of the dentition in the latter.

TREATMENT

A summary of the individual treatment is as follows:—

Cecily (*division* 1).—

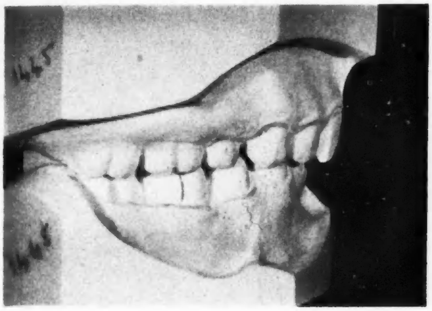
November 2, 1954. 0·020 in. labial arch-wires fitted in both jaws, freely sliding in buccal tubes on the first permanent molars, with coiled springs to retract $\overline{4|4}$ and third power bends to aline the lower anteriors. Intermaxillary traction to retract $\underline{321|123}$ and

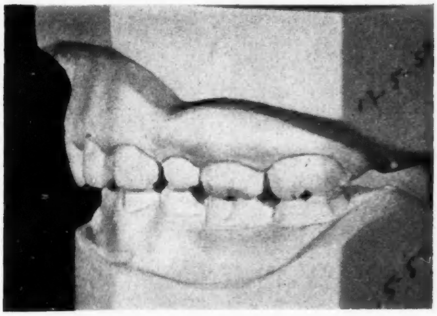
pull $\overline{6|6}$ bodily forward closing residual $\overline{5|5}$ gaps.

September 9, 1955. Upper anteriors now retroclined back to post-normal lowers. Palatal root movement of $\underline{21|12}$ instituted by means of a Begg type arch-wire.

Margaret (*division* 2).—

November 2, 1954. 0·018 in. labial arch-wires fitted in both jaws, the upper being





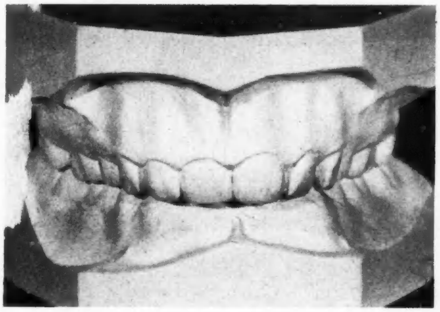
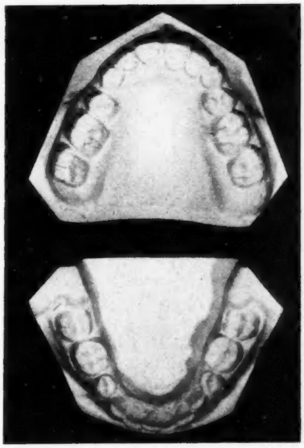


Fig. 5.—Final models of Cecily.



stopped in front of the buccal tubes, and the lower free-sliding with coiled springs to retract $\overline{4|4}$ and sprung to depress $\overline{21|12}$. Intra-maxillary traction elastics from $\underline{3|3}$ to $\underline{6|6}$ to retract the upper canines.

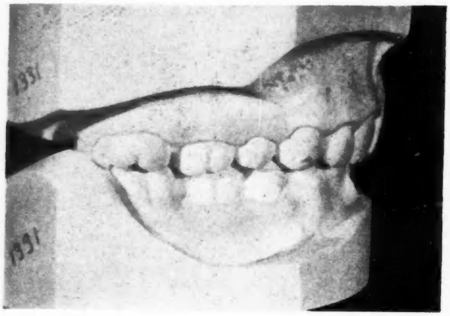
April 26, 1955. New 0·018 in. arch-wires fitted in each jaw, free-sliding, and inter-maxillary traction to move $\underline{21|12}$ roots palatally with the Begg type upper arch-wire and pull $\overline{6|6}$ bodily forward closing residual $\overline{5|5}$ gaps in the lower.

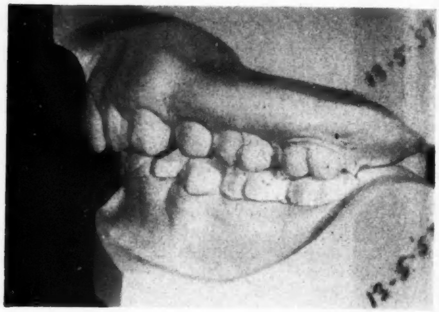
In both cases, the bands were removed on February 24, 1956, and an Andresen appliance fitted for retention. These were removed on December 3, 1956. The active treatment time was approximately 15 months, with 9 months' retention.

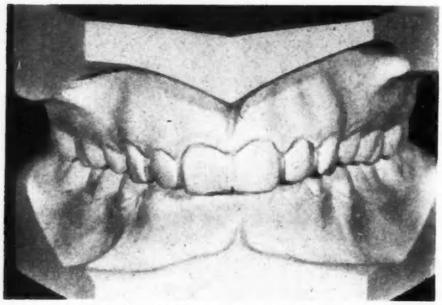
Final photographs, models, and lateral radiograph tracings six months after the removal of the retention appliances show the marked improvement in the incisor relationships and the similarity of the two occlusions in both cases (*Figs.* 4, 5, and 6). In the division 1 case there was only a slight relapse due to an over proclination of $\overline{21|12}$ during treatment, and the subsequent lingual collapse of the incisors. The upper incisors are now stable inside the behaviour of the lower lip, even though there is still a very slight tongue thrust.

A slight relapse of the incisor crowding and overbite was also evident in the division 2 case, again due to lingual collapse of the lower incisors, and in this case a relapse of the palatal root movement of the uppers.

Both cases show clearly the very limited amount of proclination of the lower incisors permissible during treatment to ensure







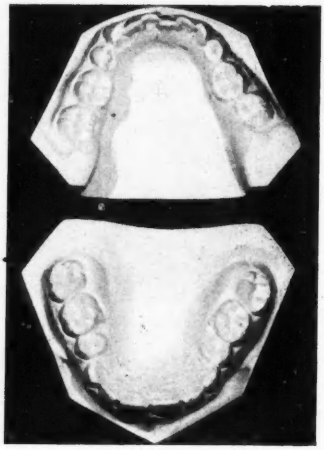


Fig. 6.—Final models of Margaret.

their ultimate stability in soft-tissue balance.

An interesting feature in both cases was the alteration of the path of closure of the mandible from the originals to a slightly forward path at the end of active treatment (about 30° to the vertical component), and a reversion to the original path after the slight lingual relapse of the incisors.

Equally as interesting is the fact that, although in the final composite tracings the general skeletal and soft-tissue patterns are very similar, the dento-alveolar structures in the division 2 case are stable in a slightly more distal position on their respective apical bases than in the division 1 case. This must surely be due to a different force of behaviour of the soft tissues between the two cases, especially that of the anterior circum-oral musculature.

No change in the respective dental base relationships was observed as a result of treatment.

COMMENT

The cases I have described prompt one to consider the aetiology of Angle's Class II, division 1 and division 2 malocclusions, and to speculate how sharp is the dividing line between the two.

It is generally accepted that the post-normality of the apical bases in both cases is

endogenous, but what are the causative factors concerned in the respective incisor relationships? Ultimately these seem to be determined by the relationship of the upper incisors to the soft tissues at rest and in function—factors which are also in the main endogenous in origin.

Whether the upper incisors erupt labially to the lower lip into the division 1 position or lingually to it into the division 2 position must initially be determined by something other than just chance.

Here such factors as the skeletal pattern, developmental position of the teeth, the behaviour of the tongue during swallowing, the constraining influence of the upper lip, and lastly, habits, must surely play an important part both in the aetiology and the ultimate stability after treatment. These factors are described more fully in recent papers by Ballard (1956, 1957).

The choice of extractions may well call for further comment, as it is generally assumed that extractions in the lower dental arch in postnormal occlusions should be avoided at all costs in order to prevent collapse of the lower arch. Where crowding is present in this arch to such an extent that it cannot be corrected by slight anteroposterior expansion, however, extractions are inevitable, especially for the purposes of reciprocal anchorage when inter-maxillary traction is being used. The second premolars were chosen rather than the first to lessen the risk of collapse, and the final models show that the posterior teeth have been moved bodily forward enough to close the extraction gaps completely—in fact so much so that there is still very slight crowding.

I would like to reiterate my thanks to Mr. Hovell, the Director, and to Mr. Walther, the Reader, in the Orthodontic Department of the Royal Dental Hospital for their help and permission to publish this case, and to the X-ray and Photographic departments concerned.

My thanks are also due in no small way to the patients themselves and the excellent co-operation of their parents.

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THE USE OF CONTOURED CANINE ORTHODONTIC BANDS*

By DORIS R. RIDLEY, L.D.S. R.C.S.

EVEN the most experienced of us must have had difficulty in making well-fitting orthodontic bands for some canine teeth. This is due to the shape of the teeth, which are conical and often bulbous on their buccal surfaces.

Making canine bands from straight strips of stainless steel is both difficult and time-consuming. A well-fitting band cannot be made merely by pulling-up from the palatal aspect. (*Fig.* 1.) It has to be shaped by cutting and welding, or soldering, to produce the contour. If pulled-up from the buccal aspect, sometimes a better fit is obtained, but the resulting band is at too high a level for accurate bracket placement. A third alternative is to shape the band by cutting and soldering before pulling up around the tooth.

However, all these methods are time-consuming and often the finished band is unsatisfactory.

While I was in the United States, I noticed that pre-contoured orthodontic bands were in use, which ensured a good fit in considerably less time. These bands are manufactured by

* Read at the meeting of the British Society for the Study of Orthodontics held on Oct. 14, 1957.

being cut in a curved pattern from sheets of stainless steel, and then contoured in a convex manner in the vertical direction in that part of the band which will be placed on the buccal aspect of the tooth.

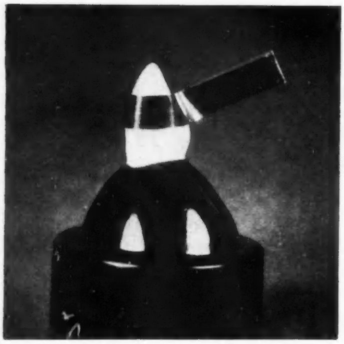

Fig. 1.—Straight band material pulled up from the palatal aspect of a canine tooth. It is seen to be ill fitting on the buccal aspect.

They are adapted to the tooth merely by pulling up from the palatal aspect with an ordinary pair of Howes pliers, and cut and soldered, or welded, at the palatal join. (*Fig.* 2.) Thus a well-fitting band may be made very quickly.

The brackets may be added before adapting or placed on the finished band. In order not to destroy the contour, it is best to slightly

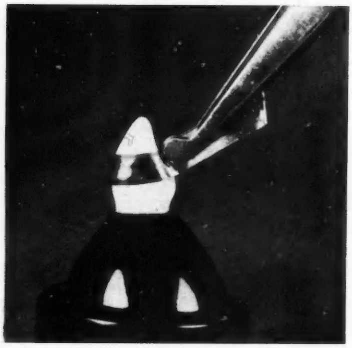

Fig. 2.—A contoured canine band being adapted. The contour of the band fits the buccal surface of the tooth.

curve the bracket with pliers and attach to the band by welding with an electrode shaped to fit the contour of the band. These contoured bands are now obtainable in England.

DEPRESSION OF LOWER INCISORS*

By **R. T. BROADWAY,** M.D.S. (Lond.), F.D.S., D.Orth. R.C.S.

THERE has been in the past some controversy as to whether or not the lower anterior teeth are depressed into the alveolus when an anterior bite-plate, or lower multiband appliance with an arch to exert a depressing force on the lower anteriors is worn. Salzman says: "that whether elongation of posterior teeth or depression of anteriors takes place when a bite-plate is worn is not fully settled".

There have been some previous investigations into the action of the anterior bite-plate, and recently Ilhan Belger (1956) reviewed the literature and undertook a cephalometric analysis of growth in subjects wearing bite-plates. He found that there was no discernible depression observed in the lower incisors, but that most of the vertical increases were in the posterior region, the premolars and molars having developed vertically into occlusion. It is a well-known clinical fact that when a tooth is extracted the opposing tooth will continue to develop vertically, until in some cases it actually occludes with the opposing alveolus.

It is not difficult to postulate then, that when the posterior teeth are separated by the wearing of an anterior bite-plate, they will continue to develop vertically until they occlude. It must be stressed that if this is to occur the bite-plate must be worn at all times. The vertical development of the cheek teeth thus results in a decrease in the overbite,

* Read before the meeting of the British Society for the Study of Orthodontics held on Oct. 14, 1957.

which may give the clinical impression that the lower anteriors have been depressed. This, although it may explain the reason for the further vertical development of the posterior dento-alveolar structures, does not explain

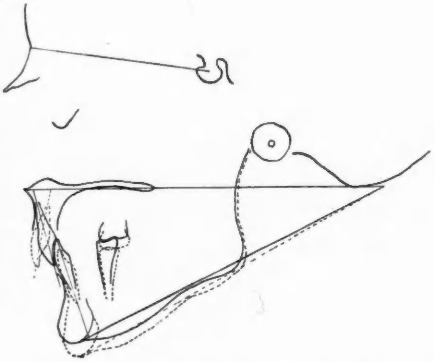

Fig. 1.—*Case* 1. Tracings of lateral skull radiographs, superimposed on S–N plane, of a patient who has worn an anterior bite-plate for two years.

why the lower anteriors are not depressed; it may well be that the patient wearing a bite-plate develops a reflex avoiding action, and that as soon as the teeth contact the bite-plate muscular relaxation takes place. Thus, little, if any, depression of the lower incisors occurs. I put this forward as a possible hypothesis. I have studied a number of lateral skull radiographs of patients who have been wearing bite-plates, but so far have not found any significant depression of the lower incisors. I have selected the following case as an extreme example of vertical development of the posterior teeth.

Case 1. (*Fig.* 1.)—The patient is an adult, with a Class II, division 2 malocclusion, who has conscientiously worn a bite-plate for two years. The tracings are superimposed on the S–N plane and it is seen that the posterior teeth have developed vertically to a considerable extent, but the lower incisors have not been depressed. In fact the bite has been opened.

Thompson (1946) has shown that the mandibular position in relationship to the head is established by three months of age. Thereafter it does not change and all attempts to increase the vertical height beyond that established by the rest position will fail. Not only does the mandible return to its resting position but invariably establishes a normal inter-occlusal clearance, or free-way space. Thus in the above type of case, if the bite has been opened beyond the normal rest position

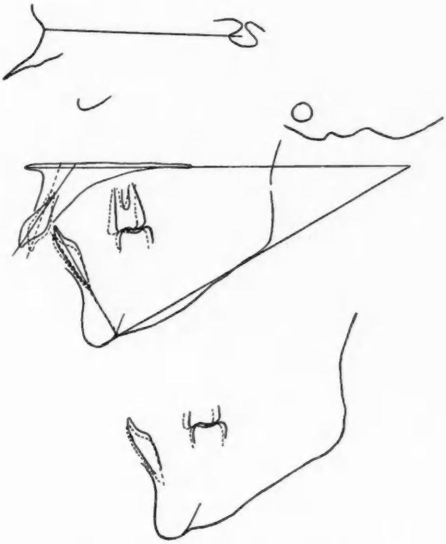

Fig. 2.—*Case* 2. Tracings of lateral skull radiographs, superimposed on S–N plane, and, the lower, tracings of the mandibles superimposed, showing depression of the lower incisors by means of multi-banded appliances.

of the mandible, relapse will occur until the normal rest position is re-established.

In the case of the multi-band appliance, different conditions apply. With this type of appliance an active force can be applied to the lower anterior teeth, using the posterior teeth as anchorage. These anchor teeth are not held out of occlusion as they are when a bite-plate is worn.

An investigation was made into some of the cases that have been treated at the Eastman Dental Hospital. These cases had arches to actively depress the lower incisors at one stage during treatment. The lateral skull radiographs were not taken specifically to show depression of the labial segment, but as a routine during progress of the cases. Thus

active depression has not necessarily gone on continuously between the dates the radiographs were taken.

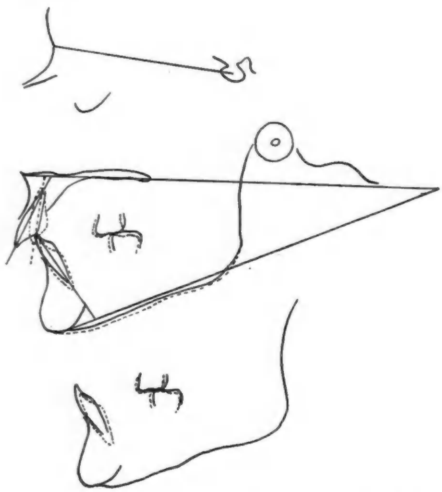

Fig. 3.—*Case* 3. Tracings of lateral skull radiographs, superimposed on S–N plane, and, the lower, tracings of the mandibles superimposed, showing depression of lower incisors by means of multibanded appliances.

The following cases were selected as they are adult or late adolescent, and growth changes are minimal.

The radiographs are superimposed on the S–N plane, and the lower tracings are of the mandibles superimposed.

Case 2. (*Fig.* 2.)—Class II, division 1 malocclusion treated with multiband appliances. There has been considerable depression of the lower incisors, with little or no elevation of the molars.

Case 3. (*Fig.* 3.)—Class II, division 1 malocclusion treated with multi-band appliances, showing depression of the lower incisors.

Case 4. (*Fig.* 4.)—A Class II, division 1 malocclusion treated by the edgewise arch technique—again considerable depression of the lower anteriors.

Thus we see that with a multi-band appliance the lower anteriors can be depressed into the alveolus. If at the end of treatment the lower

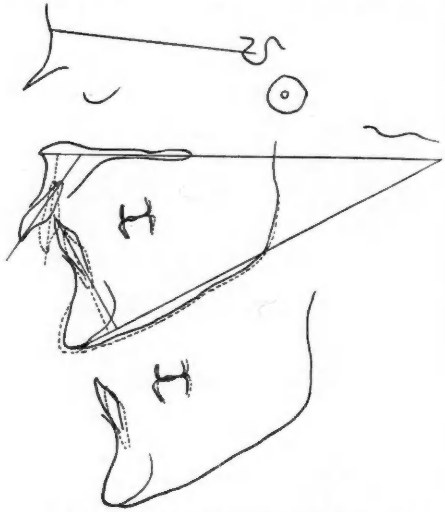

Fig. 4.—*Case* 4. Tracings of lateral skull radiographs, superimposed on S–N plane, and, the lower, tracings of the mandibles superimposed, showing depression of lower incisors by means of multibanded appliances.

labial segment is depressed so that it is out of occlusion, it will then develop vertically until it meets the upper labial segment or the palate. Where a bite-plate has been worn, and the posterior teeth have developed vertically into occlusion, they will be depressed into the alveolus when the bite-plate is removed, thus re-establishing the normal height of the bite and inter-occlusal clearance for that patient.

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Influence on Salivary Sugar of Certain Properties of Foodstuffs and Individual Oral Conditions

Salivary sugar concentrations were determined after ingestion of starchy foodstuffs and sweets. Salivary sugar elimination varied considerably between different individuals consuming the same food, and in the same individual eating different foods. Factors influencing sugar elimination were: (1) Movements of lips and tongue after swallowing; (2) frequency of chewing movements; (3) salivary flow and viscosity; and (4) salivary amylase activity.—LANKE, L. S. (1957), *Acta odont. Scand.*, **15**, suppl. 23.

LETTER TO THE EDITOR

February 7, 1958

Dear Sir,

Brash, in the general summary and conclusions which he wrote at the end of his *Aetiology*, states: "Far be it from me to make any *ex-cathedra* statement on these difficult problems, or to suggest for a moment that the evidence at present is sufficient to establish that in the main irregularity and malocclusion are inherited conditions." He does, however, suggest that "the time has arrived (1929) to substitute for the provisional hypothesis of environmental influence in the wide sense—which appears to have inspired most of the investigators and most of the discussions that have taken place in the past —the other provisional hypothesis that irregularity and malocclusion are inherited conditions, and to let that inspire future discussions and future investigations". He was doing what always needs to be done in science, that is, attempting to change the climate of opinion after it had been set too long within one particular range of inquiry, and when dogma was in danger of limiting the quest for new knowledge. Professor Ballard stands at the other extreme from the "environmentalists", but in his rigid genetic dogmatism his position seems to be as sterile as that which Brash attacked in 1929.

If Professor Ballard considers that I lay too much emphasis on environment on the evidence of the 2nd edition of *Aetiology*, I can only repeat that there I was trying to do what Brash intended: a "stocktaking, not with the object of propounding a solution or finding the cause or causes of these conditions, but of reviewing the evidence . . . and indicating the lines on which fresh investigations should proceed". In my own work I am not concerned with the place of environment or genetic factors in facial growth but in a study of the developmental processes involved. In doing this I have indulged in a great deal of speculation and would be the last to claim to have reached any position of finality. I may be quite wrong in my conclusions. I am pretty sure I am at least partly wrong. The more one studies the growth of the skull, the more one is impressed with the complexity of the means whereby the primitive chondrocranio-facial skeleton becomes the adult skull, and how the two dentitions, each made up of separate units, developing in quite separate regions, come into occlusion. If Professor Ballard can understand all these processes by inductive reasoning and no longer regards the aetiology of malocclusion as being a complex problem, he is either a genius or very innocent indeed. I would be surprised and disappointed if, in fact, a fair number of his colleagues agreed with him. He and his co-workers deserve every credit for drawing attention to certain clinical observations which they have made and for propounding certain theories regarding the aetiology of certain types of malocclusion, but when he states that "The conclusions I have come to are in accord with present-day views on the inter-relationship through evolution of form and behaviour," he appears to be using a lot of words to indicate that his inductive processes have become hopelessly involved in deductive obscuranticism

Yours faithfully,

JAMES SCOTT.

Department of Anatomy,
The Queen's University of Belfast.

BOOK REVIEWS

ORAL AND FACIAL CANCER. By BERNARD G. SARNAT, M.D., F.A.C.S., and ISAAC SCHOUR, D.D.S., Ph.D., Sc.D. Second Edition. $9 \times 5\frac{1}{2}$ in. Pp. 297 with 122 illustrations. 1957. Chicago: The Year Book Publishers. $8.50.

THIS is a good little book, written by enthusiasts on what is obviously a favourite hobby-horse. The text is good, but occasionally suffers from the authors' enthusiasm. The exposition of the crusade found in the earlier chapters lacks the economy of words found in the excellent clinical sections and might deter some readers from continuing with the book.

Sections on elementary anatomy, so often a feature of American text-books, are again found in this one and tend to break the main thread. Especially is this so with Chapter 6, which comes between the chapter on history-taking and that on the examination. The book would suffer little if this chapter were chopped completely and if the other anatomical sections were pruned till they contained applied anatomy only.

One or two statements have escaped revision in the light of recent knowledge. For example, tuberculous lymph-nodes are treated by radiotherapy, and a case of joint-cell tumour referred to on page 176 is probably the non-neoplastic condition, cherubism.

Most of the illustrations are good and the standard of reproduction excellent. However, these are difficult lesions to depict convincingly and one or two illustrations would not help those unfamiliar with the conditions.

On page 41 one finds the motto for the whole book: "The life of the oral cancer patient is in the hands of the first dentist or physician he sees." Thus this book is not a specialized account of malignant disease for the expert,

but a practical guide for the student and general dental practitioner. With this in mind the price is unfortunately high at 65s. for a book of 297 pages including index. One appreciates the problem. Such a book as this must be illustrated, and the illustrations, to be of value, must be printed on good paper. Nor are the publishers entirely to blame. If the profession bought more books, editions could be larger and probably cheaper. The authors might consider attempting to prune both text and illustrations for the next edition, so that the book might be smaller, cheaper, and therefore able to achieve the wide circulation it deserves.

G. R. S.

THE CENTURY OF THE SURGEON. By JÜRGEN THORWALD. $8\frac{1}{2} \times 5\frac{1}{2}$ in. Pp. 416 + xii, with 66 illustrations. 1957. London: Thames & Hudson. 25s.

THE history of surgery contains so much of inherent interest and drama that the bare facts need little literary adornment. It is necessary, especially in books intended for the layman as well as for the medical reader, to set the various episodes in their contemporary social background; but this is usually best achieved by telling the story in a simple, straightforward way and by making use of appropriate quotations from contemporary sources. It was with some misgivings that the reviewer read in the publisher's blurb that: "For the sake of continuity, the author has chosen the narrative device of an eye-witness, whereby he is able to present all the dramatic events he describes as happening during the life-span of one man." But any fear that this was to be another history of surgery "hotted up", with Hollywood dialogue, was soon dispelled. The book is in fact beautifully written, and the way in which the author has linked up the reminiscences of his supposed eye-witness by means of narrative passages incorporating a great amount of accurate background material can only be described as masterly. Even dialogue—and this is the greatest test of all—is handled without a jarring note. In brief, the book tells the story of the fundamental discoveries and inventions that made modern surgery possible—the conquest of pain and sepsis and the gradual invasion by the surgeon's knife of all the cavities and organs of the body. The same story has been told by scores of "popularisers", both medical and lay, but it can seldom have been told with such art and with such respect for the facts. The enormous amount of reading and research that has gone to the making of this book may not be apparent to every reader, even if he examines the comprehensive list of sources which is given; but those better acquainted with medical historiography will see evidence of the author's intimate knowledge of his subject in almost every line. The illustrations are well chosen and well reproduced, but in view of the meticulous care that has been lavished on the bibliography and on the selection of the pictures, it is a pity that the exact sources of some of the more interesting of the latter are not given. The early illustrations of Cæsarean sections, of amputation of the hand, and of a stomach operation in 1635, are taken from well-known manuscripts or books, the references to which could have been provided. There are very few errors. The Académie de Médecine appears throughout as the Academie de Medicine, and British medical readers will be surprised to see the late Sir Thomas Barlow described as a surgeon. It is Peter Chamberlain the elder, and not William Chamberlain, who has the greatest claim to be regarded as the "inventor" of the obstetric forceps. Kisato is a more usual spelling than Kitazato, and Semmelweis although spelt correctly in the text appears as Semmelweiss in the index. Carpue's second Christian name was Constantine, and Bell, Brodie, Astley Cooper, Erichsen, Hudson Lowe, Simpson, and Spencer Wells have been deprived of their knighthoods or baronetcies in the index. These minor blemishes do not detract from the value of this enthralling book, which represents a brilliantly successful attempt at an entirely new type of medical history.

C. B. H.